A CONCEPTUAL LOGISTIC SYSTEM FOR THE I.I.N.

Mehdi Rahanjam

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THESIS

A CONCEPTUAL LOGISTIC SYSTEM
FOR THE I. I. N.

by

Mehdi Rahanjam

December 1976

Thesis Advisor: E. A. Zabrycki

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The first part of the thesis describes the concept of logistics and identifies the fundamental logistics considerations, their characteristics for an effective and efficient logistics system.

The existing FMS logistic system is analyzed relative to the model to identify areas for improvement by further detail studies. A major conclusion

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A Conceptual Logistic System for the I. I. N.

by

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Lieutenant Commander, Imperial Iranian Navy
B.S., Imperial Iranian Military Academy, 1967

Submitted in partial fulfillment of the
requirements for the degree of

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I. INTRODUCTION

The concept of the logistic system and technology of logistics have made substantial advances since the last two decades. The concept of the logistic system has come to be generally recognized. Business and governmental management are now beginning to accept the need to design and manage the logistic system as a unity rather than as a series of discrete, independent functions. If independencies and interrelationships are not recognized, suboptimization will often occur with a resulting reduced overall logistic system's efficiency.

Advances in the technology of information processing and communications contribute to the capability of managing the system as a whole and the opportunity to apply substantially more sophisticated concepts and decision rules to the design and management process. Improvement in distribution technology along with progress in the management techniques in procurement functions expand the options in logistic system design.

A. PURPOSE OF THE THESIS

A well organized and properly managed logistic system is essential for the operational units to carry out their functions.

Although the Imperial Iranian Naval (I. I. N.) logistic system has met the requirements of the operating forces in the past, continuing improvement along with the expansion of the Navy is required to keep pace with

the ever changing demands for greater efficiency and economy of resources. Today, more than ever, because of limitation on resources and the unstable demands of a mushrooming technology, and also rapid expansion of the I. I. N., the logistic functions should be considered as a major part of the Naval activities.

The purpose of this thesis is to introduce the concept of the logistics system and to survey the elements of a logistic system, the concepts and techniques of analysis that can be helpful in the design and management of such a system. Further, the purpose is to present a conceptual logistic system that can be used to identify the existing system's problems and difficulties with emphasis on restruction of the present system. Specifically, the thesis focuses on the procurement operations functions, which to the knowledge and experience of the author is considered to be one of the major areas for analysis in the system.

B. STRUCTURE OF THE THESIS

Since a wide knowledge of sound logistical principles and procedures is necessary to manage the logistical activities effectively, the first section of the thesis covers the basic areas and concepts of logistic considerations. The following section describes the characteristics of an effective and efficient logistic system with emphasis on logistics organization, information, and control necessary to successfully manage the logistics functions.

Based on the two foregoing parts, the existing logistic system will be evaluated to identify weaknesses and shortcomings, if any. Because of the sensitivity of the materials, a detailed description of the existing I. I. N. logistic system will not be presented in the thesis.

The concluding chapter of the thesis recommends changes to the existing logistic system with the object of identifying efficient ways of supporting the I. I. N. operations.

II. FUNDAMENTAL LOGISTICS CONSIDERATIONS

Logistics is a very broad science, so broad that it is impossible to cover all its aspects and features in one chapter or even a book. My purpose in this chapter is to cover the general area and concepts of logistics and to give some knowledge about basic logistic consideration with emphasis on the military aspects. It is not proposed to give the answers to problems that may arise, for the answers must vary according to circumstances. Rather, it is intended to discuss factors that must be considered, and outline certain principles that may be useful guides to thought. My intent is to provide a background for which every newcomer in a logistics area can build a sound understanding of logistics. In this chapter I examine the fundamental elements of logistics -- the determination of requirements, procurement, and distribution as well as the basic aspects of organization, planning, execution and supervision, and control. It may be necessary to express that there are varied opinions as to this structural formulation, these differences arising from the position and primary interests of the individual viewing the subject.

A. WORD LOGISTICS

The word logistics is derived from two root words of similar sound but different meaning. It comes from the ancient Greek word "logistickos" meaning the art of calculation which the Greeks differentiated from the writhmetic of numbers. It also comes from a Germanic word "laub"

which means the leaves of trees and which came to mean an open shelter. "Laub" was changed to "loggia" in Italian, and to logistique" in French.[1]

Logistics in general and in the broad sense is concerned with flows of material, people, money and associated information. It deals with the managemement of physical supply and physical distribution activities and involves the total effort required to make particular kinds and specific quantities of goods available in an acceptable condition, at a certain place, at the time they are desired by the ultimate consumer.[2]

Logistics encompasses supply - along with other steps in the business of designing, producing, distributing, and maintaining the people and things that go to make up the power of security. It cannot be denied that in some measure logistics is the business of every civilian and military personnel concerned with national security. Today, more than ever, because of limitations on available resources and the unstable demand of technology, logistics is the personal concern of every military and civilian man having security responsibilities.

B. BACKGROUND OF MILITARY LOGISTICS PROCESS

In the earliest form of prolonged warfare, logistics was the supply of dried meat and spare arrows carried by the warrior. This was the simplest and basic idea. It enabled the warrior to fight longer and further away from his home.

Battles between the earliest tribes probably were fought on the spur of the moment of provocation, without a predetermined plan and without

providing special means of fighting, that is to say, tactics only was involved. After experience in battle, some intelligent warrior suggested to his fellows that they might secure advantages over their enemies by planning the affair in advance, the plan naturally suggested the stratagem. Stratagems were multiplied and elaborated until the contest became something more than a single battle fought out in one day, the final decision, indeed only being expected from a combination of battles. As soon as the battle became something more than a sudden fight of short duration, more or less of organization and preparation of means of fighting, or of executing stratagems, were called for: It was necessary to prepare hiding places, traps, means of communications and to provide food for warriors who would be prevented from hunting, by reason of military employments, for a longer period than usual. This stage in the development of warfare marks the beginning of logistics.[3]

This brief statement highlights the conclusion that military logistics deals with the generating, moving, and providing the means of war, while strategy and tactics are concerned with the employment or deployment of those means. Logistics gives material support to strategy and tactics. A plan is worthless unless the means are available to carry out the plan, likewise, logistic effort is meaningless unless the effort supports a strategic or tactical plan. This is the relationship between the strategy, logistics and tactics. It is a big mistake to separate logistics and strategy and tactics into individual arts or science. It must be remembered that one cannot be practiced or studied without an understanding of the others.

C. TYPES OF LOGISTICS

1. International logistics: the process of planning and providing goods, facilities and services for the support of the military forces and civilian economics, at the international level.

2. National logistics: the process of planning for and providing goods and services for the support of a nation's military forces and its operations, a national civilian economy and its international obligations and requirements.

3. Military logistics: military logistics as defined by the Joint Chiefs of Staff is that part of the entire military which deals with

a. Design and development, acquisition, storage, movement, distribution, maintenance, and disposition of material.

b. Induction, classification, training, assignment, welfare, movement, and separation of personnel.

c. Acquisition or construction, maintenance, operation and disposition of facilities.

d. Acquisition or furnishing of services. It comprises both planning, including determination of requirements, and implementation. [4]

This definition eliminates the broad field of civil logistics which will not be covered in this chapter.

4. Civil Logistics: civil logistics can be considered to encompass the rest of the logistic field which is not covered by military logistics. This remainder includes the support of the military forces by the civilian

economy. In time of war civilian logistics is not included in the mobilization of civilian industry and manpower but the whole economy. Control and operation of the civilian economy in time of war encompasses not only the industrial economy but all resources including raw material, capital, and labor.

5. Operational logistics: operational logistics is that part of the logistical effort relating to the military operating forces. During the war, the operational logistical effort provides the means of war for those forces whose immediate concern is obtaining success in the combat area.[5] Operating logistics is the primary concern of the military operating forces.

6. Consumer logistics: consumer logistics is concerned with the determination and distribution of the requirements of the operating forces for material, services, and personnel. This aspect of logistics is carried on at the national and departmental levels.[6]

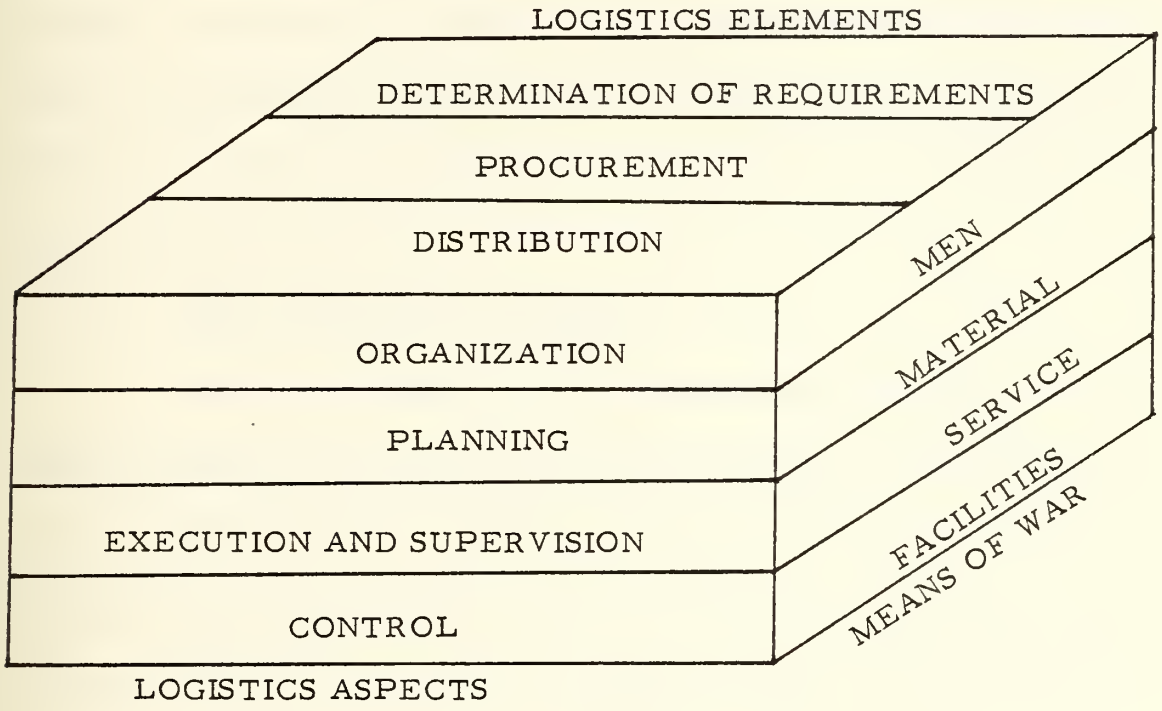
7. Producer logistics: in very general terms, producer logistics is concerned with the procurement of those operating forces requirements as determined by main headquarters. As in the case of consumer logistics, this kind of logistics is also carried on at the national and departmental levels.

D. STRUCTURE OF LOGISTICS

In spite of the difficulty of agreeing on a single precise definition, it is possible to recognize a definite structure in logistics. While this

cannot be represented in a two-dimensional sketch, it becomes clear when expressed in three dimensions.[7]

Every logistic problem can be approached in the simple terms of four broad categories of means, three fundamental elements, and four basic aspects.



Logistics Box

Figure 2-1

According to our definitions, since logistics is "the provision of the means for the conduct of a military operation," there are four broad categories of "means," which are men, material, facilities and services. In providing these means there are three fundamental elements: statement of requirements, procurement, and distribution. The determination of requirements, procurement and distribution are process of

contrast staff personnel facilitate the work of the line by acting as advisors. Therefore, they do not have authority to make decisions or give orders except in their own departments. Thus the logical solution is to combine the line and staff activities into one department. Bowersox states: "As a general guideline in establishing a physical distribution department the line function should not be created unless supported by a competent staff function.[34]

Combination of line and staff functions provides the logistics department with the analytical skills to design, plan, and analyze existing and proposed logistics systems and with the authority to exercise control over the administration of these staff decisions to the day-to-day operations. This does not mean that logistics will now operate independently and divorced from all other firm functions. The staff functions of planning, coordination, etc., must work closely with other departments to effect system changes that benefit the firm as a whole, not merely the logistics department.

b. Matrix organization. In a broad sense, logistics involves the physical flow of material which takes place in response to signals, in the form of flows of information.[2] This horizontal flow of material and information creates the basic organizational problem when one attempts to impose on this scheme the traditional vertical organization oriented around business functions. DeHayes and Taylor have suggested the use of the matrix organization for logistics as a solution to this

problem. Advantages cited for the matrix organization function for logistics are that: (1) responsibility centers, such as logistics, can be designed to accomplish planning and control in support of the overall organization's goals more effectively,[2] (2) its application is flexible to meet the specific needs of any firm, and (3) it permits the logistics manager to integrate plans and designs rather than responding to problems only. However, there are disadvantages related to this type of organization. For instance, because of the two-way flow of control the responsibility and authority relations are at times unclear and lead to conflict or uncoordinated effort.

In the foregoing discussion it is tried to identify the basic consideration of the logistics organization along with the organizational alternatives for the management of logistics-oriented activities. What is suggested is that neither approach is ideal and convenient for all companies. Structure of the firm's logistics department is a function of different variables which spring from circumstances and careful study is necessary in selecting the right approach.

B. DISTRIBUTION SYSTEM

Distributionas mentioned in Chapter I is one of the basic elements of logistics. It cannot be denied that distribution systems have a major role in each logistic activity. Change in the efficiency of the distribution system are immediately reflected in the support program and procurement situations. Therefore it is essential to have a good knowledge of

the major characteristics and elements of an effective and efficient distribution system in order to be able to evaluate the particular significance and relationship of each element to the general situation.

The characteristics of a good distribution system are: Responsiveness, Flexibility, and Economy. Experience and examination shows that these are completely interdependent and a good distribution system is impossible unless all characteristics are present and understood.[8] The purpose of each distribution system is to fill the needs of the operational forces. Therefore the system should be responsive to the operational needs of these forces, especially to the requirements and limitations of maintenance and design problems. Since the distribution system must have capability to expand rapidly and effectively from peace to war it must be flexible and be able to provide for the rapid and unexpected changes in plans and operations that characterize war. Finally the distribution system must provide the greatest possible economy in peace and in war, consistent with rendering effective support to the combat forces.[8] As far as distribution systems concerns, the commercial carriers efficiency will markedly affect the military distribution system efficiency. And also, the efficiency with which the services utilize the commercial carriers affects the efficiency of the military distribution system. The main elements of each distribution system can be considered as transportation system, storage system, and packaging and material handling system.

1. Transportation

The relation that exists between distribution and transportation is so intimate that at times the terms "distribution" and "transportation" appear almost synonymous. Transportation is a major part of the broad field of logistic distribution. Men and material must be moved and distributed not only to military operational areas, but to the mine and to the factory. This movement and distribution must meet military operational needs, and it must meet industrial mobilzation and commercial needs. Efficient transportation is an essential element of effective distribution. Efficient transportation is an essential of good logistics for it is a fundamental and continuous objective of transportation to control and diminish the time distance lines of communication by the most suitable means.[11] It is important to remember that while transportation efficiency may be improved by maximum loading and minimum turn arounds, when these are attained at the expense of reduced effectiveness of the operating forces, true logistic efficiency is diminished rather than enhanced.

The criteria by which we can judge the excellence of a transportation system are not identical in military and civilian organizations. In the business world profit and loss are the criteria of judgment, whereas in the military world these criteria are quite different and much more complex. It is not possible to place a monetary value on combat effectiveness nor is it possible to use a profit and loss criteria for logistic efficiency. Instead three different sets of criteria and three different

points of view should be used in evaluating the operation of a transportation system:[7]

(1) The maximum efficiency and effectiveness of carrier operation.

(2) The maximum efficiency and effectiveness of a supply distribution system.

(3) The maximum economy and combat effectiveness of the consumer.

Carrier efficiency is relatively easy to judge, but supply system efficiency is somewhat more difficult to judge. Consumer economy and combat effectiveness are extremely difficult to judge, so much so that many people feel we can only guess them and therefore the question of evaluation is hopeless.

There is not the slightest doubt that in a major conflict it is necessary to attain a high degree of efficiency in the use of all forms of transportation.[12] When the overloaded transportation is not responsive to the needs of the consumer, the overall transportation requirements are also generally increased. Under such considerations, statistical evidence of high transportation efficiency has little meaning if it is not related to overall logistic and combat effectiveness. Considering the fact that transportation is the basic link among an organization's plants, warehouses, raw material sources and consumers, therefore, knowledge of the transportation system is fundamental to the efficient

and economical operation of the logistics function in the organization. For this purpose we will need to know some of the basic facts and principles of transportation and to understand some of the much used terms as transportation system, facilities and services, movement control, and traffic management.

a. Transportation system, facilities and services

The transportation system is physically composed of the networks over which freight is moved and of the equipment used to transport freight. The system includes vehicles, terminals, pipes, highways, ships, waterways, canals, airways, and railroad trackage. The bulk of the freight movement is handled by the five basic modes of transportation available in physical distribution system design. The term mode is used to differentiate between the methods by which goods or commodities are physically transported.[2] The basic modes are (1) rail, (2) highways, (3) water, (4) piplines, (5) air. The various transportation agencies that facilitate and coordinate freight movement are freight forwarders, railway express, parcel post, air express, and shippers associations.[15] The relative importance of each transportation mode and the changes that are occurring in relative importance are partially explained by the composition of freight hauled and the inherent advantages of the mode. For instance, the pipeline is a highly efficient method for moving products in a liquid or gaseous form over long distances. In contrast, air freight is not so much limited in scope

by technical feasibility as by the relatively higher rates that must be charged as compared with other modes.[15]

The structure of the transportation industry is based on five mentioned modes plus a number of variations and subgroups derived from:

(1) Their several legal forms

(2) A number of auxiliary users of transportation

(3) Various modal combinations (coordinated systems)[2]

The term "legal form" refers to the manner in which a transportation operation is regarded for regulatory purposes. Four legal forms of transportation currently exist: (1) Common, (2) Contract, (3) Exempt (4) Private.

Common carriers are the backbone of the transportation industry. They accept responsibility for carrying goods any time, any place. Contract carriers on the other hand make themselves available for business on a selective basis. They may charge different rates to different customers for the same service, but they are required to publish the actual rates which they charge shippers. Exempt carriers do operate on a for-hire basis, but the restricted nature of their operation limits the need for a high degree of direct regulation. Private transportation refers to the common ownership of goods transported and the lease or ownership of the equipment in which they are moved. This not-for-hire category allows firms to transport their own goods without facing economic regulation at the national level.[2]

Auxiliary users are defined as transport agencies which purchase a major portion of their transportation from other carriers via one or more of the basic modes. They concentrate their operations on the handling of shipments of several pounds to LTL (less than truckload), LCL (less than carload), or container quantities. The last element of the structure of the transportation industry is coordinated systems which are defined as those offering point-to-point through-movements by means of two or more modes of transportation, as the basis of regularly scheduled operations.[2]

b. Movement Control

In routine resupply operations both in peace or in war, good movement control is necessary both to logistic and to transportation efficiency. And it is a fact that traffic matters can be managed effectively only when they are considered as an integral part of the overall logistics system.

While the principles of priorities and allocations apply to all areas of logistics effort, they are particularly important in transportation. Here the vital link between high command logistical decision and the practical operation of transportation systems lies in movement control.[6]

Movement control can be defined as the monitoring of a firm's use of transportation facilities with the objective of obtaining optimum use from them. It involves the selection of carrier,

documentation of shipments, generation of information about carrier services and rates, measurement of carrier performance, correct payment of carrier charges, and the establishment of measures to be taken when a transportation system does not function as it is supposed to do.[2] In a more general sense movement control may be described as the planning, coordination, and control of the movement of men, equipment, and supplies in accordance with the directives of management planning.

There is no doubt that effective control of transportation activities requires extensive documentation and a system of information flow that produces data for decision making and specific checks to provide a comparison of actual performance. My purpose here is to emphasize managerial aspects and implications of movement documentation and information.

The basic documents of transportation are the bill of lading, the freight bill, and the freight claim. In general these documents are designed for the purpose of providing identification of shipments, the free flow of goods between carriers and shippers, the billing of freight charges, the adjustment of freight charges incorrectly billed, and the settlement between shipper and carrier of claims resulting from loss or damage to products during movement.[2]

The bill of lading provides: (1) a contract for the movement of a shipment, (2) a receipt for goods itemized on it, and (3)

in some cases, a certificate of title to the goods. The bill of lading indicates where the shipment originated, where it terminated, the volume shipped, and the parties involved at the time of shipment. This document represents a valuable source of data for supply and distribution planning even though it may not contain any information about freight charges. The responsibility for preparing bills of lading typically rests with the shipper. The freight bill is the carrier's invoice for freight charges. Prepaid freight bills are presented by the delivering carrier to consignors for payment. Collect freight bills are paid by consignees. Freight claims are documents providing information about loss or damage to products in transit, unreasonable delay in the movement of freight, and freight charges, improperly assessed by a carrier. Claims are prepared by shippers for carrier consideration.[2]

At the end, it is important to remember that movement control must determine:

(1) Material or personnel requiring transportation.

(2) Where the material or personnel must be moved.

(3) The time at which such material or personnel must arrive at destination, or along the way.

(4) The type of transportation by which the material or personnel are to be moved.

c. Traffic Management

The responsibility for decision-making on the choice of transportation facilities rests in the traffic department, headed by a

Traffic Manager in many logistics organizations. The location of the traffic department depends on the size of the organization and on the emphasis placed by the company upon either sales or production. A large organization may have a separate traffic department, with the traffic manager reporting directly to the chief executive. More commonly, the traffic manager reports to the head of production or purchasing. However, in organizations where packaging and speed of service to customers are emphasized, the traffic manager may report to the head of sales.[16]

Most of the traffic manager's routine work consists of collecting accurate, up-to-date information about traffic rates, selecting common carriers to be used in transporting material or personnel, preparing claims of overcharge, damage, or loss, and auditing freight bills.[17] He is also expected to trace lost shipments, supervise the actual handling of freight, and maintain control over back orders.

In addition to these routine duties, the traffic manager helps consolidate small orders into carload shipments, arranges systematic warehouse distribution points for less-than-carload lots, studies and perfects ways of reducing losses in shipments caused by improper packaging and handling of merchandise, and selects the most advantageous or strategic destination points for shipments. It is also the traffic managers job to seek adjustments on overcharges caused by discriminatory rates, he actually prepares cases and presents

them before commissions and government bodies.[18] He must know when to use rail, water, truck, or air to transport goods to customers. And he should help to select plant and warehouse sites that will insure desirable transportation service.

d. Factors of Transportation

At the end of the transportation discussion it can be concluded that there are four basic factors or criteria in analyzing the efficiency and effectiveness of each transportation system. These factors include (1) speed of delivery, (2) cost of delivery, (3) flexibility of delivery, and (4) bulk delivery. These factors relate directly and closely. In evaluating a mode of transportation, the user must consider and weigh it according to his specific needs.[19]

Speed of Delivery: In the highly competitive environment of the business world, managers often demand a transportation system that can provide rapid delivery of merchandise so that the maximum time utility can be added to the product. In some cases, such as with fashion goods or perishable items, speed of delivery may be the most important consideration. Consequently freight costs will be expensive to get items to market rapidly. Time is a crucial factor in deciding which system to use.

Cost of Delivery: A prime factor in selecting a carrier of goods is cost. The user of transportation services must carefully analyze the cost of each system to be used. He will normally choose

the service that meets his specific needs at the lowest rate. The transportation costs are included in the price at which goods are sold. Hence, as transportation costs increase, the cost of goods to the buyer increases. If the cost factor is ignored, a product can be literally priced out of the market, with resulting harmful effects to the business.

Flexibility of Delivery: A transport system must be flexible so that it can adapt to the special needs of individual shippers. An inflexible transport system which does not adjust to changing customer needs fails in its service function completely. In our rapidly changing world, flexibility will be an increasingly important criterion for evaluating a transport system.

Bulk Delivery: The ability or the inability of a transport system to ship different types of goods is a necessary consideration. Where bulk items are being shipped, the user should recognize that some systems are much more able to meet his needs than others. Hence, a large shipment of iron ore would not ordinarily be shipped by air but by some other system designed to meet the shipper's needs.

2. Storage System

In contrast with transportation, storage takes place primarily at the nodal poïnts in the distribution network. As one analyst put it, storage is little more than transportation at zero miles an hour.[20] In many firms warehousing comprises the major portion of the operations over which logistics management has control. To the extent that

inventory control is the heart of the logistics function, the warehouse is the veritable center of the logistics system for any one firm.[2] It can not be denied that mechanization has improved labor productivity and increased the capital investment required for efficient warehousing operations. Unit load, automated, and semi-automated warehousing techniques have been developed to minimize handling costs at the price of high capital investment in warehouse facilities. There is no doubt that a good and efficient storage system has a great influence in overall logistics readiness and efficiency. For the purpose of discussion, this part focuses, first of all, on the nature and importance of warehousing. This will be followed by the basic warehouse operations, types of warehousing and costs of warehousing.

a. Nature and Importance of Warehousing

Warehousing is often defined as the storage of goods prior to their use.[22] Broadly interpreted, this definition includes a wide spectrum of facilities and locations which provides warehousing, such as open field storage of iron ore, storage of raw material and finished goods, and highly specialized storage facilities such as farm product storage in bean and grain and products which require refrigeration, etc.

In a macro-economic sense, warehousing performs a very necessary function. As Heskett states: warehousing absorbs the shock caused by inflations in demand and supply.[2] The major advantage of

warehousing lies in creation of time utility for raw materials, industrial and finished products. The proximity of market oriented warehousing to the customer allows the customer to be served near points where desired. More importantly, warehousing increases the utility of goods by extending or broadening their availability on a time basis to prospective customers. In other words, by using warehouses, companies are able to make goods available when and where they are demanded.[23]

The basic demand for warehousing is determined by the quantity and variety of commodities that require storage. Thus, warehousing exists because companies inventory commodities. Inventories, can be divided into two general categories - physical supply (raw materials) and physical distribution (finished goods). Both types of inventories are stored for some of the same reasons. In almost all companies, transportation and production economics are paramount reasons for creating inventories. The cost savings in transportation alone are sufficient to cause many companies to warehouse inventories in order to take advantage of this opportunity. Stopping the production line is usually harmful and expensive. Never shutting down the line for lack of raw material is a common rule in many organizations. To avoid this situation, adequate stock of raw materials are maintained. Efficient and balance production runs for different products also dictate that sufficient warehouse space for finished goods be provided.[23] In

summary it can be said that uncertain consumption patterns, variation in production levels, and fluctuations and uncertainties in the price of goods, along with the high cost of instantaneously responding to uncertain economic conditions, are the primary reasons for a storage system.

b. Basic Warehouse Operations

The basic warehouse operations are movement and storage. Storage is probably the most obvious warehouse function, whereas movement may seem unrelated to warehousing. However, here by movement aspect of warehousing I mean short distance movement which is a very vital aspect of warehousing. The essential processing or functions that an efficient warehousing activity should include are:

(1) Receive goods. The warehouse accepts merchandise delivered from outside transportation and then accepts the responsibility for it.

(2) Identify goods. The appropriate stock-keeping units must be recorded and a record made of the number of each item received. It may be necessary to mark the item by the use of a physical code, tag, etc. The item may be identified by an item code, a code on the carrier, or container, or by physical properties.

(3) Sort goods. The merchandise may be stored for the appropriate storage area.

(4) Dispatch goods to storage. The merchandise must be put away where it can be found later when needed.

(5) Hold goods. The merchandise should be kept in storage under proper protection and condition until needed.

(6) Recall, select, or pick goods. Items ordered by customers must be selected from storage efficiently and grouped in a manner useful for the next step.

(7) Marshal the shipment. The several items making up a single shipment have to be brought together and checked for completeness or for explainable omissions, and order records must be prepared or modified as necessary.

(8) Dispatch the shipment. The consolidated order must be packed suitably and directed to the right transport vehicle. Necessary shipping and accounting documents must be prepared.

(9) Prepare records and advices. The number of orders received, items received, and items on hand must be recorded, as a basis for replenishment action and stock control, or the demand and receipts data must be forwarded to a control center located in headquarters or elsewhere.[24]

Warehouses come in all forms and degrees of specialization. Some are highly specialized, to handle products under a controlled environment or under secure conditions (for example, ammunition or weapons). They may be designed to handle dry bulk products or

fluid products in bulk, or they be little more than protected open areas.

c. Types of Warehousing

There are two most common functional arrangements of warehouses, assembly warehouses and distribution warehouses. Assembly warehouses are often used by firms purchasing large quantities of agricultural goods from a large number of sources spread over a wide region. They also may be used by industrial firms which normally purchase a great quantity and wide variety of goods from different suppliers. Distribution warehouses, sometimes referred to as market warehouses, are often used for the mixing and trans-shipment of carload and truckload shipments moving from producing points to large number of customer locations.[2] The nature of these two types of warehouses are indicated in Figure 3-1.

From the ownership point of view a business firm has three alternatives in regard to warehousing: (1) private ownership, (2) private operation of leased facility, and (3) public warehousing. Leased and owned facilities have a great many characteristics in common and generally have been grouped in the category of private warehousing. The important distinction for logistics management is that between public and private warehousing. A public warehouse is in business to offer storage and handling facilities usually on the basis of a short-term commitment, to any company or individual. Usually the public warehouse, in addition to providing storage space on a short-term basis,

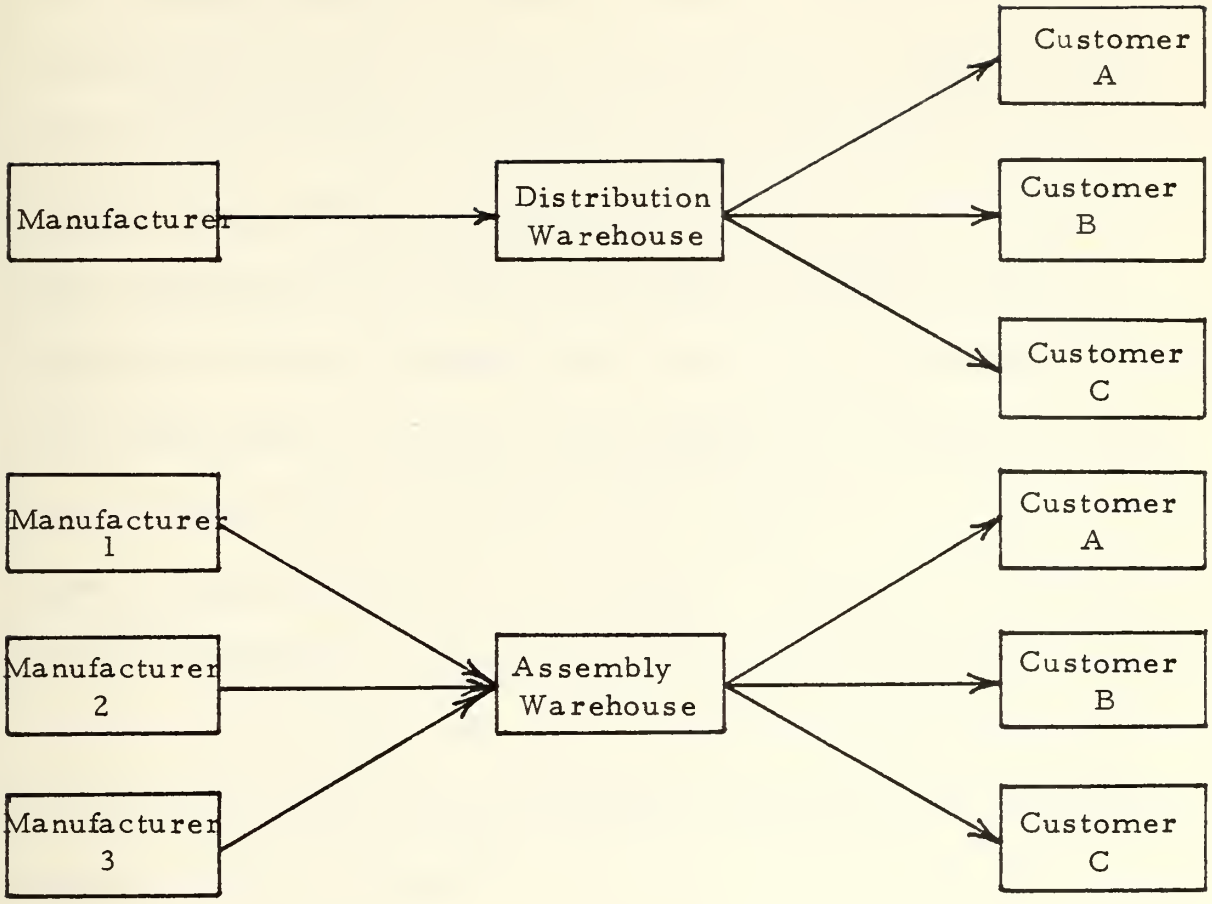


Figure 3-1

offers custodial and handling service as well.[24] The public warehouse will also perform receiving, handling and shipment, assembly and loading operations. A modern public warehouseman should be well equipped to deal with problems of labor, insurance, and other matters related to warehouse design and operation. He should be prepared to offer a full range of facilities, equipment, and manpower on a long or short term basis to support a customer's distribution activities. Perhaps the greatest advantage in the use of public warehousing facilities is the

great flexibility allowed in inventory location. A firm using public warehousing can shift the location of its inventory to reflect changes in the transportation rate structures which make existing warehouse locations comparatively uneconomical.[2] Another advantage which a public warehouse service offers a distribution system manager is opportunity for use of an explicit and clear warehousing expense derived from storage bills. Perhaps a more important, if intangible, disadvantage is the difficulty of integrating public warehouse use into the total logistic management system of a company. Efforts to use public warehousing on a flexible, in-and-out basis may create problems in training and informing salesmen, customers, and central system controllers concerning the location and use of public warehousing and the specific makeup of stocks available.[24]

Private warehousing has many economic and other appeals to managers of logistic systems. The firm may expect, with some reason, to have greater control over the warehouse operations and may believe that it can achieve more efficient operation as a result. If a company builds and owns its own warehouses, it can see that they are designed for the efficient handling and storage of its products, thus, private warehousing has an advantage when the product poses unusual handling or storage requirements. In general if the volume of the warehouse is low and stable, the average cost to handle a unit through a private warehouse is reasonably lower.

d. Warehousing Costs

In order to be able to measure the variation of costs at different levels of activity, it is important and even necessary to identify separately costs which are primarily fixed or variable. Warehousing fixed costs are generally costs of rental or depreciation on building and equipment, utilities, insurance, fixed property taxes, and maintenance. Costs which are more variable in nature are those of inventory property tax, warehouse labor, equipment maintenance, penalty charges due to delay of carrier equipment, supplies and depreciation of containers, pallets, and other devices used in utilization of freight. Total cost analysis is essential in the overall evaluation of the efficiency of maintaining a privately operated warehouse versus utilizing the facility and service of a public warehouse. Increase in number of warehouses obviously affects the total cost of warehousing for any particular firm. But one of the most important decisions made by logistics managers is in answer to questions of how many warehouses to have in the system. As was the case when I discussed the advantages and disadvantages of private opposed to public warehousing, it would probably be best to view the general trade-offs in such decisions. The important costs affected by increasing the number of warehouses in a logistic system on the physical distribution side are transportation costs, cost of lost sales and stockouts, inventory cost, and warehousing costs. Transportation costs decline as increase in the number of warehouses brings

the warehouses closer to the customer and market area, thus reducing the distance results lower transportation costs. Warehousing costs increase because the total amount of space and associated elements (labor, facility, utility, and etc.) will always increase with a large number of warehouses. There is more total inventory carried when the number of warehouses increased with consequent higher cost of inventory. Because of availability of merchandise in market area and retail stores, the cost of lost sales and being out of stock will decrease when the number of warehouses increases.

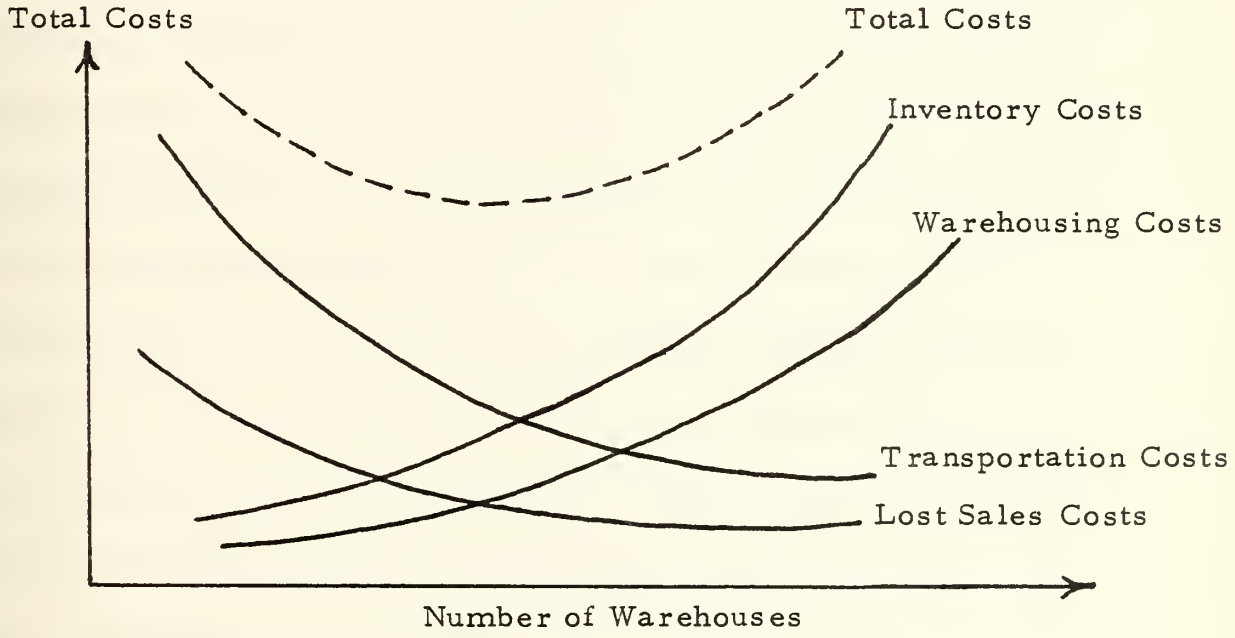


Figure 3-2

As indicated in Figure 3-2, total cost will generally decline over a certain range as the number of warehouses increases. It is obvious that the nature of products and raw materials as well as the type of

activities of each firm affects in the slope of the total cost curve and the range of warehouses over which it will decline. At the end of this part and as a conclusion it can be said that the warehousing decisions are very, very important ot the effective design of logistic decisions. In particular, the decision about ownership (private versus public) and the question of how many warehouses are central to the logistics system design.

3. Materials Handling

From the logistic point of view materials handling is defined as that portion of the business system which affects the relationship of materials and packaging to the product, facility, or customer without adding usable worth or changing the nature of the product.[25] Materials handling is quite important to the efficient operation of the warehouse and in transferring goods into and out of the warehouse and also in moving goods to various storage points in the warehouse. Since the handling can either be performed by advanced mechanical equipment or performed by manual labor or both, it is most convenient to think of materials handling as a short distance movement which usually takes place within the areas of a building such as a plant or a warehouse.

a. Materials Handling Principles: Materials handling such as any art or science has its own principles. The principles that apply most widely are:

(1) Handling costs must be reduced to minimum possible amount.

(2) Handling must be eliminated wherever possible, and where it is necessary, the work should be done by mechanical means, not by hand.

(3) Handling methods should be correlated with operation, inspections, storage, and other handling that comes before or afterward.

(4) Handling routine must be made as nearly automatic as possible so that the costs are minimum.

(5) All handling systems should be integrated in order to obtain greater efficiency.

Effective materials handling methods increase productivity and thus deliver goods to more consumers at less cost. The ultimate in materials handling efficiency is obtained by applying the principle: "The more pieces, pounds, or tons of material that are moved in a specific time, at a constant cost, the lower the handling cost per piece, pound, or ton."[25]

Material handling considerations are an integral part of the storage space decision. If the choice is public warehousing, compatibility of the firm's materials handling system with that of the public warehouse is a prime consideration. If a company operates under the use of private warehousing policy, the efficiency of the entire materials handling operation is concerned.

There is no doubt that one of the major sources of savings in the logistic system lies in the cost of handling through processing and

distribution. Thus, the objectives for material handling are to reduce handling cost and to increase space utilization. Improved materials handling efficiency developed along four lines: (1) load unitization, (2) space layout, (3) storage equipment choice, and (4) movement equipment choice.[15]

(1) Load Unitization: As Weir states, the fundamental principle of materials handling is, that the economy of materials handling is generally directly proportional to the size of load handled.[26] It means as the size of the load increases, the number of trips required to store a given quantity of goods decreases and hence the greater economy results. The number of trips relates directly to the labor time necessary to move the goods as well as the time that the materials handling equipment is in service. Efficiency often can be improved by consolidating a number of small packages into a single load and then handling the consolidated load. This is referred to as a load utilization and is most commonly accomplished through palletization and containerization.

(2) Space Layout: Total materials handling cost is directly affected by the location of stock in the warehouse. A balance between the materials handling costs and the utilization of warehouse space is highly emphasized in designing the warehouse and associated materials handling equipment.

(3) Storage Equipment Choice: Storage and materials handling often must be considered in concert. In a way, storage is simply a temporary halt in the flow of materials through a warehouse. Storage aids promote the full utilization of space and improve the efficiency of material handling.[15] One of the most important storage aids is the rack. Racks are shelves usually of angle iron on which goods are stored. The other storage aids are shelf boxes, horizontal and vertical dunnage, bins, and u-frames.

(4) Movement Equipment Choice: Three broad levels of materials handling may be recognized in the functions performed in a warehouse. Manual handling makes use of human power and thought to move goods. This type of equipment provides some mechanical advantage in movement of goods and requires only a modest investment. In general the flexibility and low cost makes manual equipment valuable when the product mix in warehouse is dynamic. However, the use of the equipment is somewhat limited to the lifting and pushing capacity of the operator.[15]

Mechanical handling supplements manual power with mechanically powered devices, but human thought is required to control the selection and routing of merchandise. This type of equipment permits high stacking of loads and the movement of loads of substantial size. Fork trucks, conveyors, tow tractors, and stockers are in this category. Automated handling equipment employs mechanical devices

to supply the power and control the movement of goods under general and often remote human guidance. For effective use of this type equipment, information processing devices such as a computer and communications system should be used to: (1) maintain status records on matters such as item locations and inventory levels, (2) process orders, and (3) issue picking, and dispatching instructions.

It is important to remember that in the overall design of a material handling system, one efficient component does not necessarily guarantee an efficient system. Efficiency is not only influenced by such factors as the level and periodic fluctuations of volume handled, local wage rates, on the relative cost of space. It also depends on the manner in which the various components are fitted together to form an integrated system.

C. PROCUREMENT SYSTEM

Procurement can be considered as a second major element of logistics system. It is an important and correlated function of management. Routine decisions involving large amounts of funds in the purchase of raw materials, component parts, equipment, supplies or products either for resale or consumption are the day-to-day rule for personnel engaged in procurement activities.

Before proceeding farther, it may be desirable to define the term "procurement" as contrasted with the term "purchasing." In general

purchasing is a sub-system of procurement system. It includes the individual functions assigned to the purchasing department. Purchasing describes the process of buying - learning of the need, selecting a supplier, negotiating price and other pertintne terms, and following up to insure delivery. Procurement covers wider areas and includes the duties performed by purchasing, as well as such additional functions of materials supervision and management as inventory control, receiving, incoming inspections, and salvage operations.[21]

The following reasons seem to be the most fundamental reasons for which procurement has been recognized as one of the major functions of each logistics system.

1. The wise expenditure of money is extremely important to the well-being of every individual and company.

2. In most industries, purchased materials and services comprise the largest class of expenditures.

3. The investment in raw material, parts, and supplies inventory in most companies is substantial, and the efficient management of such inventory can contribute significantly to profit.

4. The stream of salesmen and direct mail advertising which enters the purchasing department, brings information about new products, materials, and new and improved ways of doing old jobs. Proper communication and relationships with other functions such as engineering, production, and sales provide one means of keeping the entire organization informed on new developments. In an age of rapid change and

technological development the importance of keeping up to date can hardly be over-emphasized.[21]

1. Procurement Functions

Purchase and control of materials are vital in the effective control of the quality of the product, the maintenance of operating efficiency, and the quotation of favorable prices in a competitive market.[27] The task of obtaining goods that will meet the requirements of production unit in civilian organizations and operating forces in military organizations involves unusual skill and ability.

The successful operation of any modern industrial organization is dependent in large measure on the procurement of the proper equipment, materials, and supplies of the right qualities, in the right quantities from the right source, at the right price, and available at the right time. All these functions of procurement are important, the omission of any one of them may result in an unefficient procurement activity.

The right quality means that quality which is necessary for accomplishing the purpose for which the item is bought. With a merchandising business, proper quality may even mean that quality which the concern's customers want to buy, at prices they can afford to pay. Any other quality does nothing to help increase customer satisfaction or the volume of sales.[28] The right quantity refers to the volume necessary to maintain uninterrupted production in a merchandising business, and uninterrupted operation of armed forces in case of military

organizations. Interruption to production, caused by a shortage of raw materials, can be costly, but interruption to operation of combat forces may be extremely dangerous to survival and existence of a country. The proper supplier is one on whom the buyer can depend for some of the various factors involved in his purchase. The supplier is responsible for delivering the quality and quantity ordered, at the specified place and time, and at the agreed upon price. These duties together with some others are referred to as the supplier's service. The procurement department should consider service ahead of price. The right price is one which bears a fair relation to the quality and service required. It must also be a competitive price - no higher than the vendor charges the other customers. Last, it is a price which the buyer can afford to pay while continuing in a relatively safe position with his competitors.[28]

Right time is the most important function in procurement activities. Good quality, right quantity, and proper price have no meaning when needed materials are not available at the required time. In case of military organizations, timing is more considerable and critical than business firms. The timing of delivery is an essential prerequisite to satisfactory performance by the supplier. It is procurements responsibility to see that time schedules are met.

2. Procurement Responsibilities and Authorities

The primary responsibility for procurement functions is increasingly being assigned to the purchasing department. The extent

to which the purchasing department can accomplish its basic functions is dependent upon the responsibilities and the authority assigned to it by top management. A purchasing agent or manager is the responsible chief of purchasing department, and the number of clerks and specialized buyers on his staff will be determined by the size of the organization. In order to have an efficient purchasing system, the following essential authorities and responsibilities should be delegated to purchasing department.

(1) The purchasing agent should be legally authorized to commit the company for the purchase of materials, subject of course to any limitations imposed by the board of directors of a company.

(2) Satisfaction of the company's different departments needs. Along with the responsibility, however, goes the duty of checking completely all purchase requests against the need, to be sure that the request is justified.

(3) The checking of the material specification contained in the purchase request is of importance. Specification must be clear and explicit in order that the buyer and vendor can be absolutely certain they are considering the same thing.

(4) It should be clearly understood that the purchasing department should have the sole responsibility for all contracts with vendor's sales representatives to the final approval and/or adjustments of the vendor's invoice. All contracts of vendors with functions other than purchasing should be arranged by purchasing. Only in this way can

purchasing be in a position to handle its responsibilities effectively.[21]

(5) The selection of source of supply is a basic responsibility of the procurement function if there is to be effective performance of the function.

(6) The responsibility for price and other conditions necessary to obtain delivery at the right time belong to purchasing if the objectives of the procurement function are to be achieved.

These responsibilities and authorities are basic to the proper performance of the procurement function.

3. Purchasing Relations with other Departments

A purchasing department is the center of a large part of a company's business activity. By its very nature purchasing has continuing relationships with all other departments in the firm as well as with the firm's suppliers. Purchasing operations cut across all departmental lines. Purchasing and other departments often view common problems differently.

The purchasing-production relationship begins at the time the production department transmits its manufacturing schedule to the purchasing department. When production does not allow purchasing sufficient time to purchase wisely, many needless expenses enter into the total costs of a company's production. When production is not given sufficient time to develop competition, premium prices are certain to be paid for materials. By the very nature of their activities,

purchasing and production are in positions to make vital contributions to the make-or-buy decision.[29]

Engineering is usually responsible for preparing the technical specifications for required materials and equipment. To execute this responsibility effectively, engineering must have the constant help of purchasing and production. Purchasing department should develop patterns of cooperation which can be of substantial assistance in working out problems of material specification and product design. Such cooperation not only aids each function in performing its specific responsibilities with greater facility but also can have substantial influence on profits.

Direct relationship between sales and profits is recognized almost by all companies. Cooperation between the sales department and procurement can be of substantial value to both. Where the sales department keeps procurement advised of its projected sales forecasts and any special factors which may arise which have direct bearing on either increasing or decreasing sales volume, procurement is better able to determine future requirements of materials, parts, and supplies.[21] Adequate advance notice of needs permits the careful planning which results in greater effectiveness in purchasing.

It is just as important for purchasing to inform finance of changes in its schedule as it is to inform production and sales of these changes. If the purchasing department places orders to take advantage

of unusually low prices without consulting the finance department, the company could find itself paying for these purchases with funds needed for other purposes.

The type of relationship which exists between top management and purchasing can have a considerable effect on effective purchasing. In those companies where the head of a purchasing department has a voice in top operating councils, he can plan a purchasing policy with greater understanding and regard for company policy.[21]

The foregoing discussion has attempted to point out some of the more important relationships which exist or are possible between purchasing and other recognized business functions. It is obvious that development and coordination of these relationships should contribute substantially to the effective operation of almost any logistics organization.

D. LOGISTICS INFORMATION SYSTEM

Between the environment and the logistics manager there exists an information system that aids the logistics manager in his decision process. As Berenson states, logistics information system is an interacting structure of people, equipment, methods, and controls, which is designed to create an information flow that is capable of providing an acceptable base for management decisions.[30] The design and control of information flows is one of the most critical responsibilities of

logistics management. The quality, speed, and accuracy of information within the logistics system facilitates integration of all logistic activity centers of all organizations. On the other hand, a poor communication network which allows order bottlenecks or information errors to go undetected, can create lack of the balance required for an effective and efficient logistics system. As one author states a typically management information system is composed of three major elements: (1) logistics information system, (2) financial information system, and (3) personnel information system.[31] Hence when discussing a logistics information system, it should be recognized that typically it is part of a total information system.

1. Structure of the Logistics Information System

Decision making is the main purpose of obtaining information. The logistic manager may develop both informal and formal ways of acquiring the information that he needs.

Since the computer has become an integral part of business operations, there has been a trend toward more formal and highly structured information systems. The capacity of the computer for data storage and manipulation is increasingly making it more central to information system design.[15] However, it is not suggesting that every information system should be computerized, but the computer has unquestionably expanded the manager's information base.

The logistics information system, whether computerized or not, is indicated in Figure 3-3.

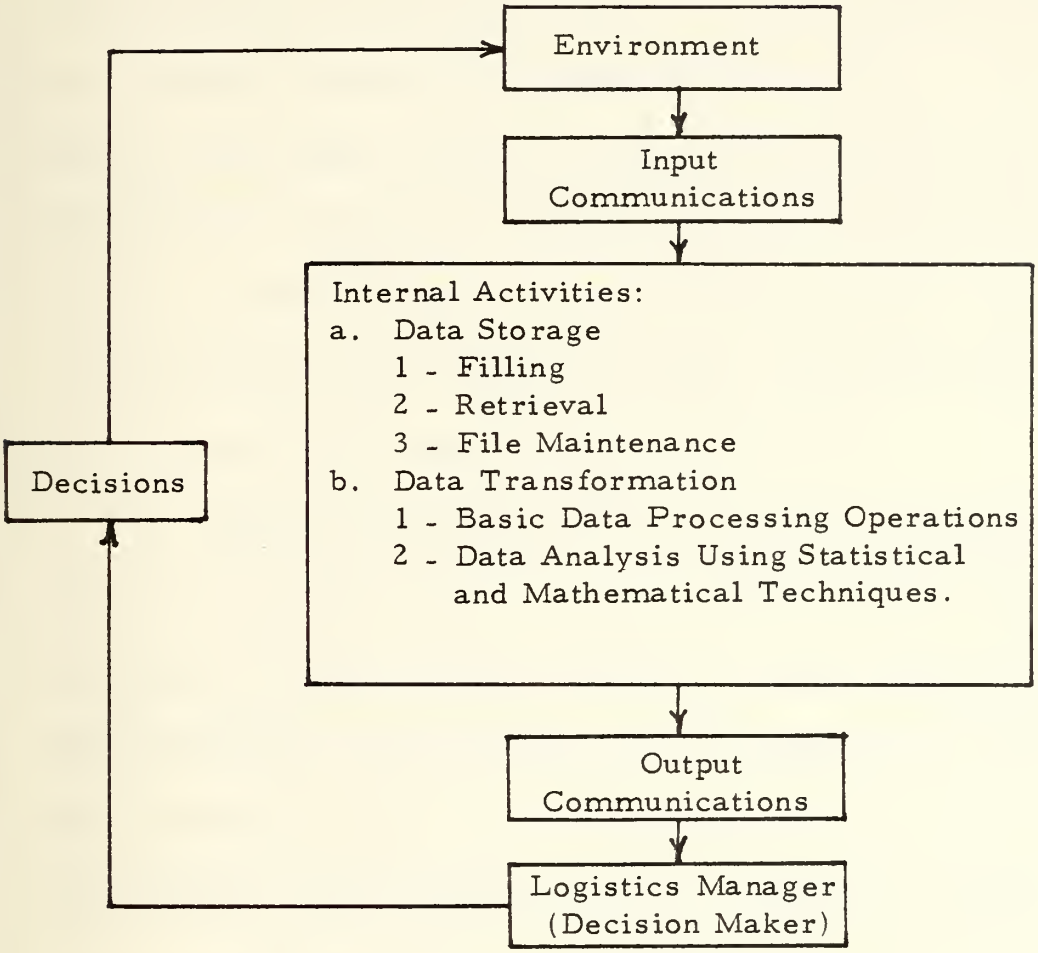


Figure 3-3: Source (15)

Three primary activities take place within the system: (1) the communication of input data, (2) the processing and storage of input data, and (3) the communication of the data from storage or after it has been processed. The logistics information system includes various models developed to assist in evaluating logistics system design alternatives as well as standard statistical routines for manipulating

data. Order processing which often is treated as synonymous with the logistic information system.[15] The information system can be divided in two distinguishable parts. The first includes mathematical and statistical models that facilitate analysis of data. This system does not make final decisions and does not initiate any action. It is referred to as a decision-assisting system. The second part is referred to as a control system. It is similar to the first, except that the decision loop is closed within the system. This system will respond to data from environment and initiate some action.

Control system compared with decision assisting systems may create a distinct danger for the manager which should be recognized. When a manager delegates a certain amount of his decision-making responsibility to a set of rules and procedures, he may lose direct control over the decision activity and ultimately control over efficiency with which the activity is carried on. Hence, when an information system includes control systems, proper actions need to be taken to prevent managerial loss of control.

2. Functions of Information System

Data obtained from the environment are not always in the form needed for decision-making purposes and/or available when and where needed. Thus, the information system should provide facilities in order to be able to use proper information for logistics decision making. The basic functions of any information system are: (1) transforming

data into a more useful form, (2) transferring data to points in the logistics network where they are needed, and (3) storing data until they are needed.

(1) Transferring data involves the movement of data throughout the information network, with the greatest movement being to and from a data processing point. The requisition transmittal link from units to supply points in a military organization is a common example of transfer activity.

(2) The transform function is a data conversion activity to create information that the logistic manager can use for decision making. Basic transformation function is composed of data sorting, checking, comparing, and manipulating using arithmetic operations. Transformation activities, unlike transfer activities, usually take place at a single, centralized point in the information network.

(3) The storage function, like the transform function, is often centralized as well. Storage activities involve filling, retrieval, and file maintenance.[15]

The foregoing functions are the basic functions of any information system. In addition to these general functions, the logistics information system has three managerial functions: (1) order processing, (2) systems control and monitoring, and (3) internal communications.

(1) The information system should provide for effective and efficient order processing. A managerially designated maximum of

speed and a minimum of error are objectives of the order processing procedure. The effect of a decrease in order processing cycle results in a decrease in reaction time to a customer order and consequently a lowering of system safety stock. Low safety stock means low inventory holding cost. In this case, of course, there is atrade-off between increased communications cost (by using more sophisticated and expensive devices) and decreased inventory carrying cost.

(2) The system control and evaluation function of the logistics information system may be subdivided into two subtasks. The first task is a command function, and the second is a monitoring function.[13] After an order has been processed and order documentation completed the system must prepare shipping directions. Within the logistics system appropriate instructions must be directed to distribution centers and common carriers in order to insure proper order fulfillment. This command function can either be performed automatically through an integrated data processing system, or it can be done manually either through verbal or written instructions.

The monitoring function is an extremely important aspect of the logistics information system and logistics management responsibility. If the logistic information system is used as a monitoring device, management must establish specific systems objectives insuring feedback.[13]

(3) The third managerial function of a logistic information system is to insure a timely and accurate flow of information to

functional areas outside of logistic. Useful information can be transferred to most of the functional areas in the typical organization by a logistic information system. Accurate and timely transmission of data to other functional areas of a firm has a great share in improving the overall efficiency and effectiveness of organization.

IV. A PROPOSED LOGISTICS SYSTEM

A. A PROPOSED LOGISTICS SYSTEM

Chapters II and III of this thesis are devoted to an analysis of the general subject of military logistics and considering the major factors and characteristics which are key elements in improving the logistic system's efficiency and effectiveness. In this chapter as a final task of this thesis I intend to propose a logistic system for the I. I. N. based on the foregoing chapters.

The proposed logistic system is devoted to the thesis that while we must expect to make new mistakes in the logistics of a future activities, we should not repeat the old ones. It is dedicated to the principle that the cost of naval operations can be reduced by the avoidance of past mistakes, by the adherence to proven methods and techniques, and by the conscious, unremitting effort on the part of everyone to improve the operating efficiency of the I. I. N. logistic support system.

It is not claimed that the proposed logistic system can resolve the problems and difficulties of the existing system. But it can be considered as an opening to a more effective and efficient logistic system for our Navy. The object of this chapter is to challenge its readers to find better, cheaper, and more efficient ways of supporting the naval operations.

A. PRINCIPLES

A list of logistics principles is considered in designing the proposed system to serve as a foundation for improvements. These principles represent fundamental logistics truths that the proposed system should consider.

1. The principle of logistics resource limitations

Total logistics resources are limited in relation to the total defense demand.

2. The principle of variable logistics support

The variable mission importance and urgency of need of supported forces, together with economic and other constraints, dictates an I.I.N. logistics systems capability for varying the quality and quantity of logistics support.

3. The principle of tactical relationship

When a tactical naval capability is significantly related to a logistics systems element or function, then tactical decisions will dictate logistics decisions and, logistics decisions will dictate tactical decisions.

4. The principle of interservice systems compatibility

Compatibility and interface of individual component policies, procedures, and support systems are requisites for fully effective and economical interservice logistics support.

B. OBJECTIVES

Logistics systems exist solely to provide responsive support to the operating forces. Supporting material management systems will be designed and operated with this paramount fact in mind. Present and future resources limitations, nevertheless, demand maximum efficiency, elimination of unnecessary duplication and inventories wherever operationally acceptable and economically beneficial.

These objectives set forth broad goals whose attainment will result in more efficient and effective logistics operations. Actions implementing these objectives will include analysis to determine effective and efficient policies, systems and procedures based upon consideration of mission accomplishment, system performance and resource expenditure.

C. NATURE OF THE SYSTEM

In designing the proposed logistics system, the main elements, aspects, and tools of a logistician (discussed in Chapter II) is considered as a basis and skeleton of the system. General format and configuration of proposed system is given in Figure 4-1.

The major procedure, and methods indicated herein by directive words such as "must" or "should" are mandatory and strongly recommended. The use of the word "may" indicates that the procedures and methods described are not necessarily mandatory.

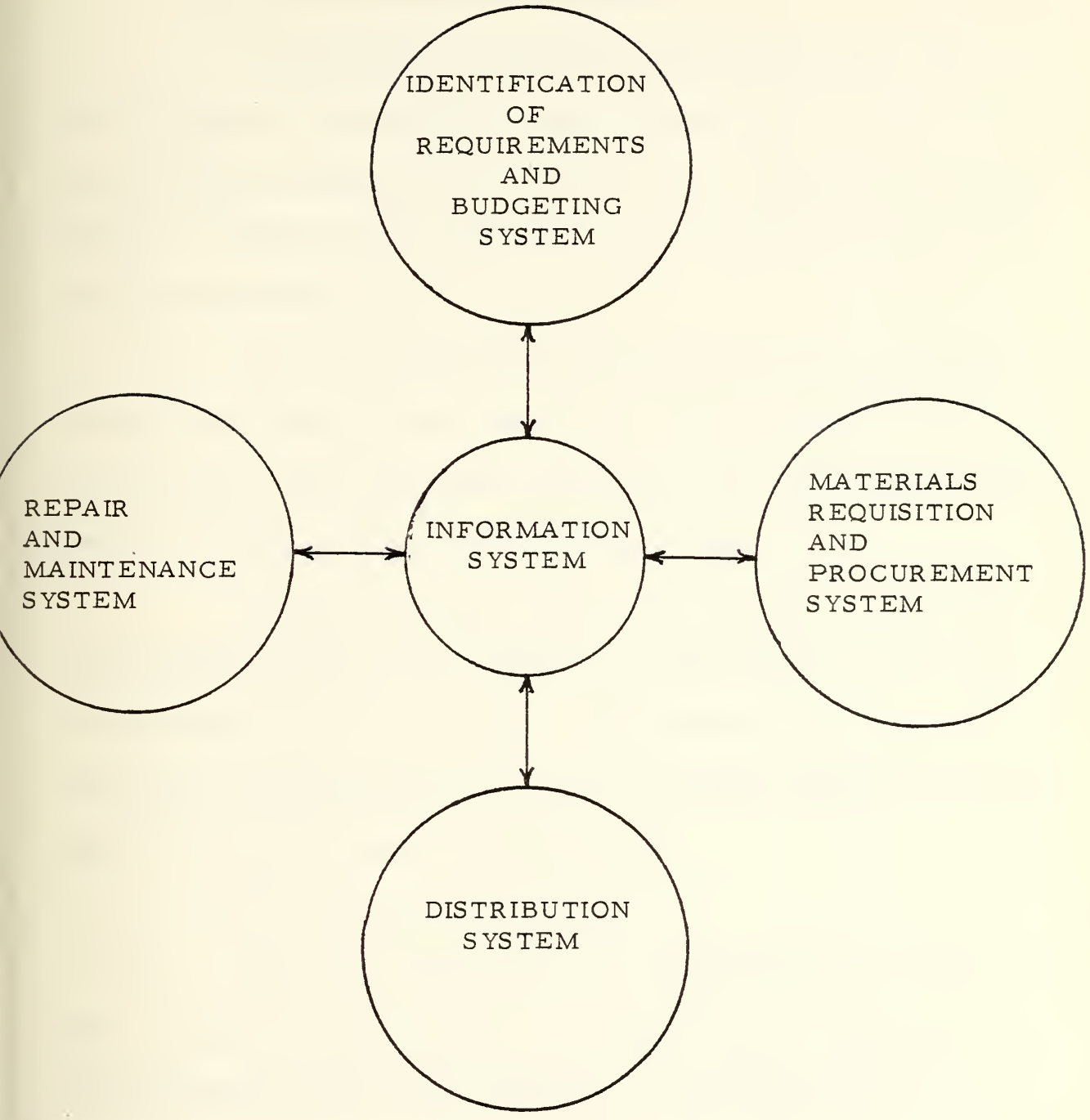


Figure 4-1

PROPOSED LOGISTICS SYSTEM

1. Determination of Requirements and Budgeting System

a. Determination of requirements

Determination of requirements must take place at all levels of logistics organization. Before delegating the responsibility of identification of requirements to different levels of logistics organization, it would be better to identify the basic types of items required by operating forces and other units.

In a very general sense there are two basic types of materials used by units: (1) items which their rate of demand is deterministic and can be clearly identified by approved tables, (2) materials which demand for them cannot be predicted with certainty.

Mobil support ships, shore bases and main headquarters are the units which have responsibility in identifying the requirements of items fitted in the first category. Each of these levels should determine their requirements and each level's prediction should be controlled and verified by one higher level organization.

b. Forecasting

Forecasts, particularly short-term forecasts of demand, play a vital part in the operation of a logistic system. Identification of the requirement for the items which their rate of demand is not deterministic can be performed by forecasting. In forecasting it is important to understand the types of forecasts that will be needed, the forecasting process that may be used, and the nature of forecast errors which the

logistic system must accommodate. Three types or levels of forecasts may be distinguished in general:

(1) Long-term forecasts, for example, for from three to ten years, used in the analysis of fixed commitments and requirements for new warehouses or dockyards.

(2) Medium forecast, often for one year is more considered in this system, used to plan procurement of raw material and spare parts.

(3) Short-term forecasts, for from one week to three months, used to control stock replenishment in the face of short-term demand variation.

The responsibility for first type forecasting is with main headquarters, and for the two other types of forecasting rests with shore bases, mobile support ships and operating forces.

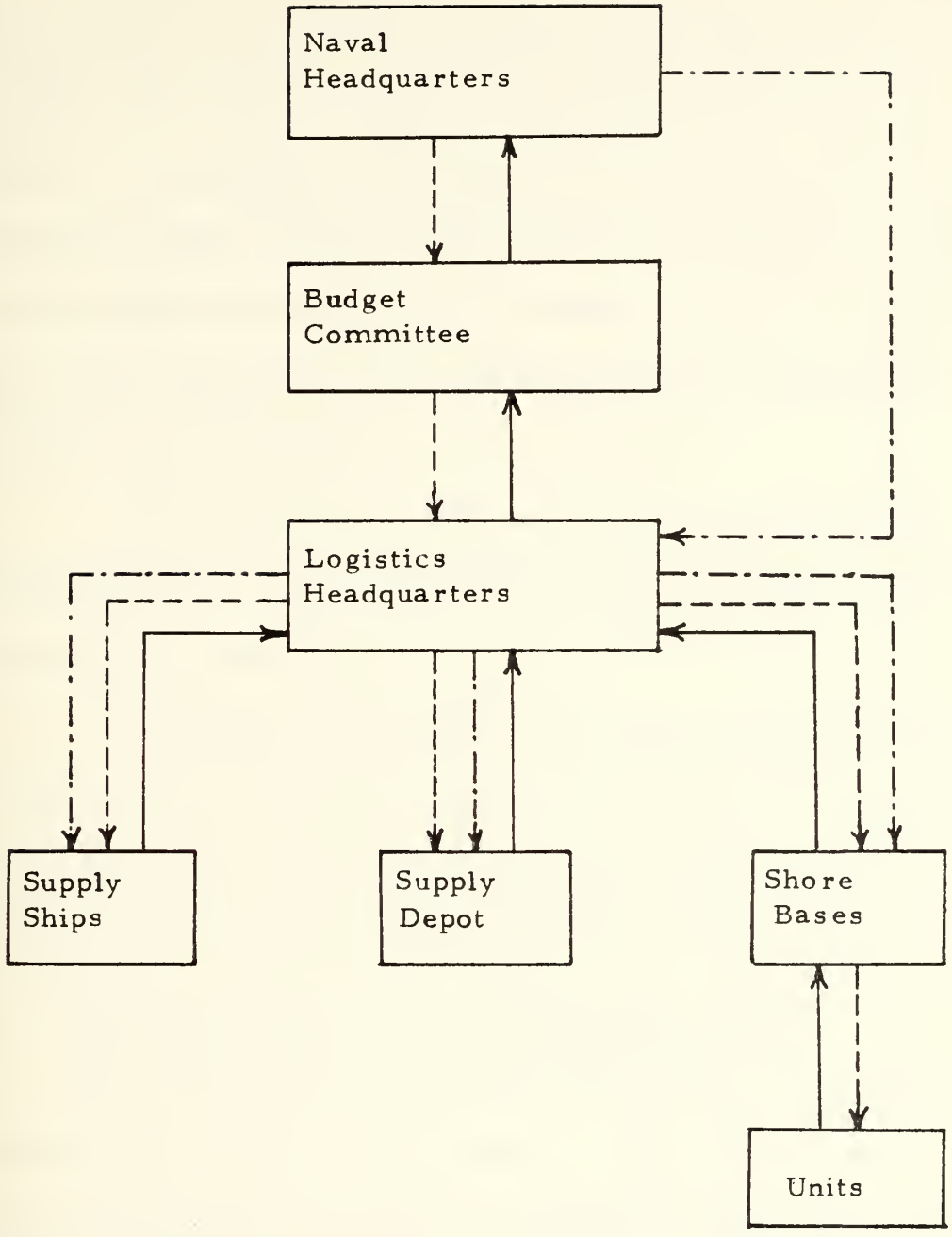
c. Budgeting

Part of top management's planning function includes searching for long-run, medium-run, and short-run alternatives. Here my purpose of budgeting is medium-run budgeting which is an estimation of required budget for satisfying the identified needs in one fiscal year. Preparing a budget demands the joint efforts of all executives involved with setting goals, devising policies that require action, or activating procedures within the organization. In the proposed logistic system the formal budgeting procedures are delegated to a budget committee,

which is responsible for preparing and distributing the budget. The budget committee ensures that budgets designed for different levels of the organization cover the applicable planning period and contain enough detail so that units have sufficient direction. Effective budgeting requires data inputs from each department. Executives from each department of logistics main headquarters form a budget committee to whom they delegate the process of budgeting. The Controller or chief financial accounting officer is responsible for organizing and administering the budget program. He ensures that the committee receives all appropriate budget estimates, and that each estimate is revised according to any additional information obtained by the committee.

d. Flow of Budget

Once the requirements for the next fiscal year activities are identified by responsible units, the next step would be estimation of the required budget. Units responsible for identifying the needs, should also estimate the relevant budget. The budget is estimated by different levels of organization on the basis of data prepared and distributed by budget committee. One of the budget committee's responsibility is to provide appropriate data for budget estimation. The main source of required data could be published price lists, quotations and proforma obtained from the suppliers by the purchasing department. Historical data and standards used for maintenance of weapons and equipments published by the standard office of Armed forces is another source of data.



Flow of information

Flow of requirement and relevant estimated budget

Flow of approved budget (fund)

Exhibit 4-1

Each department of logistics headquarters receives the budgets estimated by its sub-department in shore bases, supply depot, and mobil support ships. Departments of logistics headquarters are responsible for checking, controlling, and consolidating their sub-departments budget. The last check point for the estimated budget of the entire logistics organization is the budget committee. Estimated budget of each department will be submitted to this committee for final investigation and justification.

The interrelationships between the budget committee, naval headquarters, and operating divisions of the logistics organization are illustrated in Exhibit 4-1.

It should be noted that most of the requirements will be procured by the purchasing department of the logistics headquarters and approved budgets will not be committed to the units entirely. Additional detail about this issue will be given in the purchasing section.

2. Materials Requisition and Procurement System

Most procurement actions are executed by the purchasing department in the logistic organizations. Figure 4-2 indicates the influences exerted upon and from the purchasing department, and the relationships between purchasing and other logistics functions in the proposed system.

Environmental inputs serve as constraints to purchasing as well as other departments. Top management should establish

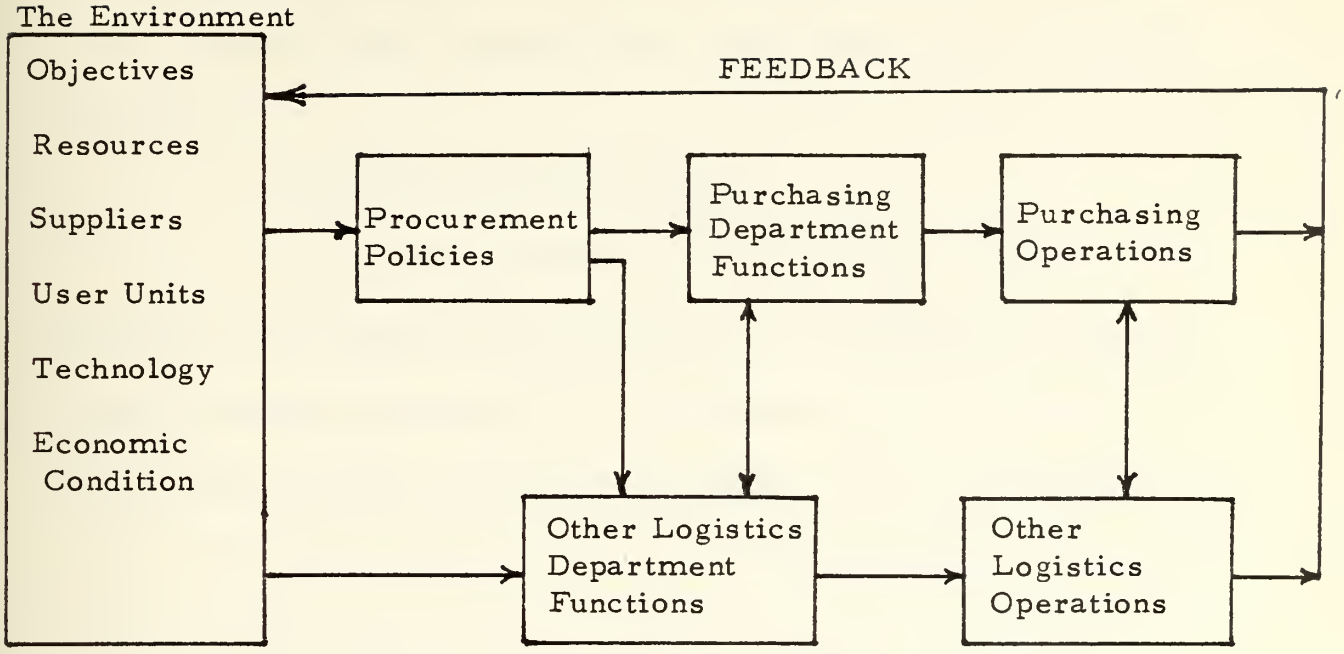


Figure 4-2. Source (2)

Exertion of Influence

Exertion of a Relationship

procurement policies based on environmental constraints and departmental inputs in terms of feedback information. Therefore procurement policies define purchasing department functions. In turn these functions define purchasing operations.

The purchasing sections (buyers) from the local post (local buyers) to the main purchasing department in the logistics headquarters are the points of immediate contact between the demand generated by the operating forces, shore bases, and the supply depot and the domestic and foreign resources and facilities which are available to meet their demand. The responsive and continuous control of input into the system

is fundamental to the execution of any supply management plan and can not be achieved without the aggressive cooperation of all purchasing activities.

a. Centralization of Purchasing

Centralized purchasing for major items is highly recommended for the proposed logistics system. Centralization of the purchasing function is essential for the attainment of both optimum operating efficiency and operating forces readiness. Because decentralization runs counter to the management concept of specialization, it is generally inefficient and wasteful. The concept of centralized purchasing is universally accepted by management authorities today. The principal advantages of a centralized purchasing activity for the proposed system are:

(1) Duplication of functions and haphazard purchasing are minimized by the central coordination of all Navy purchases.

(2) Quantity discounts are made possible by consolidating all Navy requirements for the same and similar materials.

(3) Transportation costs will decrease by the consolidation of orders and delivery schedules.

(4) More effective inventory control is possible because of wide knowledge of stock levels, material usage, lead times, and prices.

(5) Centralization develops purchasing specialists whose primary concern is purchasing. Purchasing specialists inevitably buy more efficiently than less skilled persons who view purchasing

as a secondary responsibility in each department.

(6) Line departments such as operating forces, mobil support ships, shore bases, etc., do not have to spend their time for purchasing. They can devote full time and effort to their basic responsibilities.

(7) Responsibility for the performance of the purchasing function is fixed with a single department head, therefore, facilitating management control.

b. Organization for Purchasing

Quite obviously, the organizational form of a purchasing department is dependent upon a number of factors. Considering factors related to the proposed logistics systems, such as the nature of products, domestic and international suppliers, etc., the following organizational structure for the purchasing department is offered.

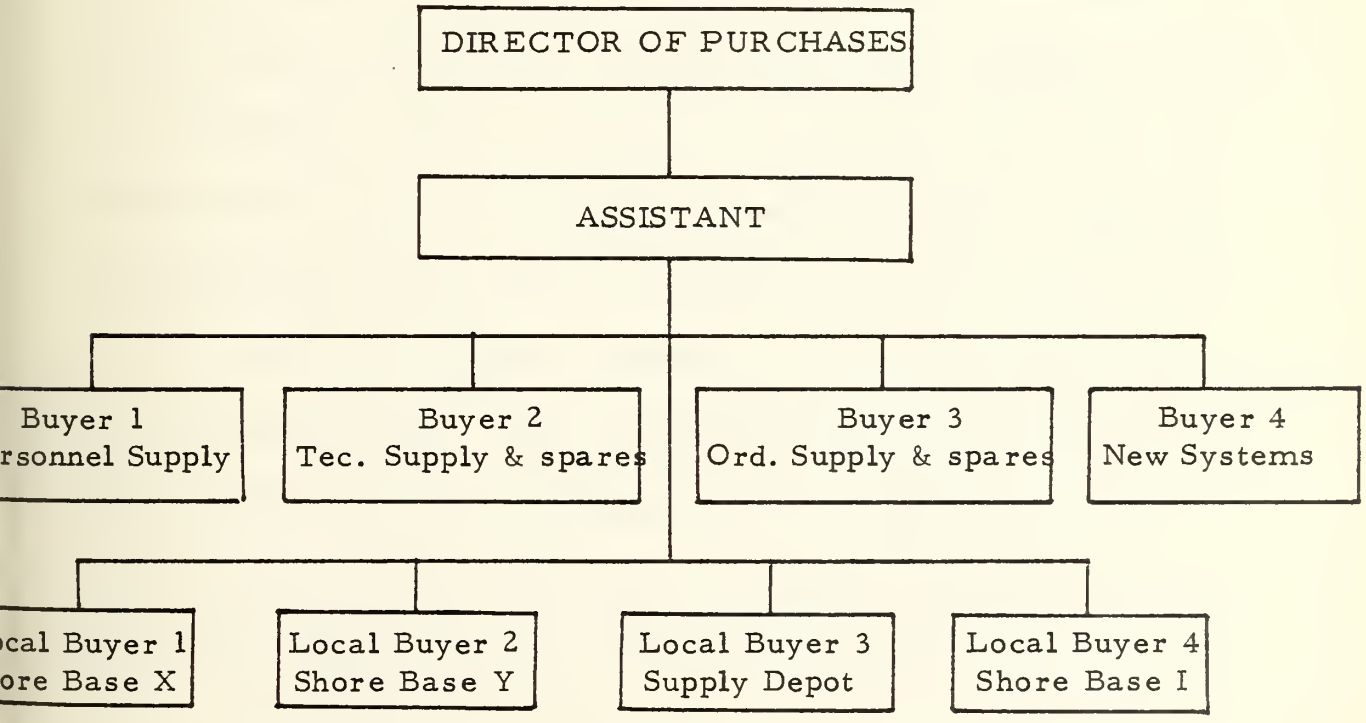


Figure 4-3

The department should be headed by a responsible administrator, known as "director of purchases" supported by an assistant. The director of purchases himself reports to the Chief of Naval Logistics. The purchasing executive himself may or may not engage in any actual buying depending on the nature of the item. He will usually be engaged in most purchases done by buyer 4's department. His time may be fully occupied with policy matters at the departmental level; in approving general contracts, and in matters that are primarily administrative in nature, such as coordination with other departments and within his own organization. The Director of Purchases is responsible for the managing of the "buyers," it is the group that actually perform the buying functions. They review the requisitions received from different departments, match them with the estimated budget, select the source, award the contract, and arrange for delivery. Each buyer's section is commonly assigned a particular commodity or group of commodities. Buyers 1 through 4 are located in the logistics main headquarters. They are operated by specialists who concentrate on the purchasing of major items with which they are thoroughly familiar. Local buyers are purchasing department's agencies in supply depot and different shore-bases. They are responsible for the purchasing of items which can not be bought and stored for long period of time by buyers located in main headquarters. Example of these kind of items are dairy products, vegetables and perishable foods. They can also

buy emergency spare parts, equipments, and items which are available in local markets. Local buyers should not be allowed to buy commodities exceeding a certain amount of contract value assigned by procurement policy. The advantages of the proposed organization for purchasing department are: (1) It allows the buyer section to become a specialist in one or more related types of commodities. Such specialists are in a position to buy to the best advantage of the I. I. N. because of their greater knowledge of the materials, their markets, price, sources, and individual salesmen. (2) Confusion within the department itself, as well as throughout the logistic system, is reduced to a minimum because of definitely assigned responsibility for all requirements of a given item. It also facilitates the consolidation of requirements.

C. FUNCTIONS OF BUYER SECTIONS

Within the guidelines established by the I. I. Navy procurement policies, the purchasing department is responsible for conducting procurement functions. Some major functions of buyer sections are:

1. Description of Need

The prerequisite to any procurement action is to define what will be procured. Three different but related criteria are helpful in specifying the "what." These criteria include the purpose, design, and quality of material to be purchased. These criteria should be obtained through the department asking for purchase of a specific item.

2. Selection of Source

Within the guidelines established by Naval procurement policies concerning "alternative source of supply" buyer sections have the primary responsibility for identifying, evaluating and establishing contact with potential suppliers for materials required by different departments. Buyer sections may establish a "shopping list" of potential suppliers and maintain up to date records regarding supplier products, prices, and services.

3. Determine the Timing

"When to procure" is keyed to delivery requirements and the schedule lead time. Buyer sections with considering the estimated or historical lead time for each item should order materials in such a way that the user units can have it right on time.

4. Determine Quantity

The quantity of items required by the operating forces should be obtained from the associated department in main headquarters. Buyer sections must have explicit knowledge of the quantity of items which should be purchased.

5. Selection of Procurement Techniques

Purchasing responsibilities include those for determining (1) alternative methods or forms in which items may be purchased, (2) assessing constraints which may dictate the form in which such items must be received. The proper form in which to order goods can be suggested by material handling and storage capability of each

department.

d. Material Requisition and, Order Processing

Since order information is vital to the effective planning and operation of the logistics system, order processing is generally one of the most important of the logistics activities.

In this proposed system mobil support ships will be treated as an independent unit which are supplied directly by the supply depot. The advantages of this method are: (1) facilities the job of shore bases and they can devote more time to their basic responsibilities, (2) more effective inventory control is possible, (3) when one of the two units (shore base and support ship) is out of stock or possibly destroyed, the remaining unit existing to supply the fleet.

In the proposed system, supply depot, shore bases, mobil support ships, and all operating forces must have safety stock and re-order point for each item of material. It is obvious that safety stock and reorder points depend directly upon the lead time of each items. The responsibility of determining the above mentioned stock levels rests with the departments of the logistics headquarters. According to this system operating units will request needed items either from shore bases (home ports) or mobil support ships when they are alongside or operating at sea. Requisitions from shore bases and mobil support ships will go directly to the supply depot and when the level of inventory in the supply depot reaches its reorder point, requisitions for replenishment will be issued to the relevant department of the

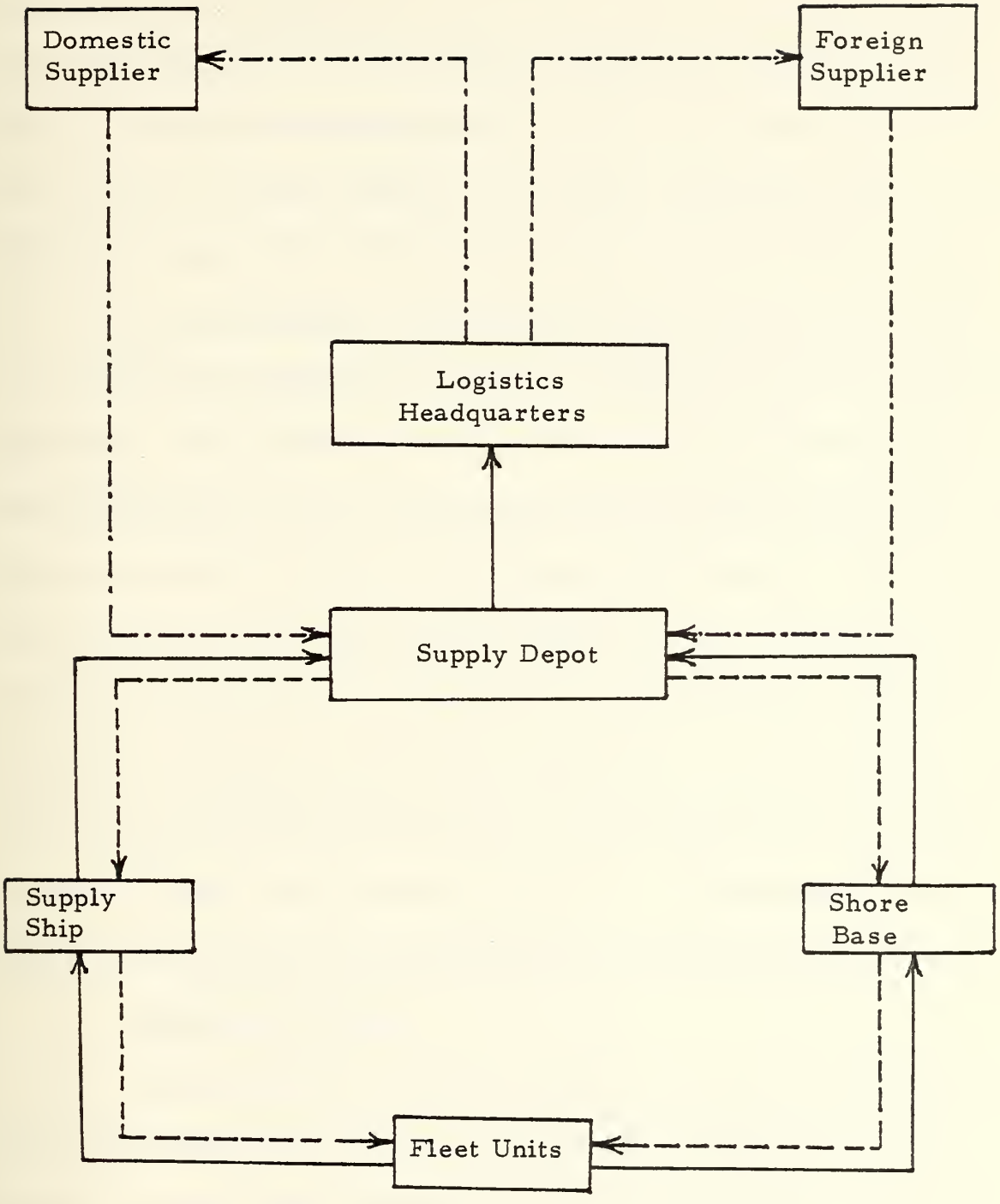

Domestic Supplier
Foreign Supplier
Logistics Headquarters
Supply Depot
Supply Ship
Shore Base
Fleet Units
Procurement route
Replenishment route
Requisition route

Figure 4-4

logistics headquarters. The responsible department in the logistics headquarters will identify and forward the quantity and specification of the required item(s) to the purchasing department. It is the responsibility of the purchasing department to procure the item(s) either from the domestic or foreign supplier(s) according to the nature of the item(s). Purchased items will be delivered to the supply depot by the supplier. For receiving, inspection, and acceptance of purchased materials there is a need for an independent department composed of a group of different specialists. This department will report directly to the commander of the supply depot as well as the headquarters functional department, purchasing department and finance department of the logistics headquarters. The main purpose for adding this new department to the organization of the supply depot is to minimize the poisoned contracts. Received items will be inspected by this department and the result will be passed on to the above mentioned departments so that they may add the items to their inventory, make payment, and other relevant affairs. An illustration of requisition and material flow is given in Figure 4-4.

3. Distribution System

Once quantitative material requirements have been determined and supplies have been procured by the purchasing department, the supplies are the responsibility of the logistics distribution system until issued to the ultimate user (ship). The functions of the proposed distribution system are:

a. Transportation - The movement of supplies to, within, and from the distribution system.

b. Storage - The process of receiving, holding and carrying for supplies prior to the issue.

c. Materials handling - The type and characteristics of equipments required for different warehouses.

Supplies ordinarily remain in the hands of the users until they are consumed, become unserviceable, or become obsolete. Unserviceable supplies usually are restored to serviceable condition by repair and maintenance activities and returned either to the user or to the distribution system.

The purpose of this system is to move supplies from the producer or manufacturer to the user units. It should be accomplished in as nearly a straight line as possible with minimum number of stops. The goals of the system are to be responsive to the user, to be sufficiently flexible to adopt to rapidly changing conditions, to be economical in terms of use of physical and manpower resources, and to be resistant to disruption by either the forces of nature or enemy action. Since the existing distribution system operates satisfactorily, it appears there would be no need to create a new distribution system. However, for further improvement in overall system's efficiency it would be useful to consider the following recommendations:

a. Transportation

The essence of transportation is the movement of masses. It is accomplished by the operation of many kinds of vehicles in the dimensions of time, distance, and load. Wings, wheels, and keels fly, roll, and float different defense items from where they are to where they are needed - various modes and combination of modes provide strategic, logistic, and tactical mobility.

(1) Transport decisions

Transport decisions are important to the logistician because of their frequently recurring nature. Constantly changing requirements force continual reconsideration of transport decisions. One of the most common decisions that should be considered by the transportation department (in the logistics headquarters or sub-departments) while planning transportation activities is transport service selection. Selecting a service to move goods or a mixture of goods is a difficult task complicated by the number of both tangible and intangible factors that need to be considered. Factors should be considered in the service choice are:

(a) Rates and total charges via the various available types of service.

(b) The time involved in the service or combination. Faster or slower service may be important under certain circumstances.

(c) The convenience of a given method of shipment. Packaging requirements, location of carrier's facilities relative to the supply depot or

shore base's shipping and receiving point, availability of special equipment for efficient handling of goods, and availability of pickup and delivery services are all necessary considerations.

(3) Experience regarding a carrier's safe delivery performance and reliability in handling goods requiring special treatment such as refrigeration and security.

(2) Movement Control

All transportation is subject to movement control. In routine resupply operations both in peace or in war, good movement control is necessary both to logistic and transportation efficiency. In the highest levels the broad policies which govern shipments between areas, and the volume of movements into each major area, should be controlled by a movement control section which is a sub-department of the transportation department. The control of volume should be exercised by allocating transportation capacity or lift. This section should have authority over both the movement of cargo carried by military and civilian transportation modes.

The overall movement control section should work in harmony with the movement control systems on the lower levels. Each shore base and supply depot should have its own movement control section. A movement control section should be aware of movement by all means and methods. If control over sea, air, and road is not brought together in one control section, serious deficiencies may develop.

Movement control and carrier operation may be considered as two sides of the same broad coin of transportation. One directs the movement, the other carries it out. Since movement control is a vital link between the logistical decision of command and the practical operation of the transportation system, movement control sections (sub-dept. of transportation de.) should be interested and consider the following specific facts which are essential to transportation planning.

(a) What material and personnel are to be moved in the support of the supply depot, shore bases, and mobil support ships.

(b) The time and places this material and personnel will be available for lifting.

(c) Advance notice of the arrival of ships and precise knowledge of their cargo.

(d) The means of identification of material and personnel and its relative urgency.

(e) The base loading capacity, the backlog and the inflow at each port of embarkation.

(f) The program of arrival of shipments from other areas or from external movement control systems.

(3) Containerization

In transporting cargo from the supply depot to shore bases and mobil support ships, use of containers is strongly recommended. Containerization allows the packing of goods of like or unlike characteristics

in an enclosed box to eliminate rehandling of materials in their transportation from supply depot to units. The advantages of using containers in supplying the navel establishment are:

(a) Lower handling costs resulting in lower freight rate.

(b) Lower in-transit insurance costs.

(c) Reduction of cargo damage in transit.

(d) Reduction or elimination of pilferage during shipment.

Obviously for handling containers there is a need for adequate equipment and facilities which should be provided by the transportation department.

(4) Coordination with other departments

Coordination between transportation and other logistics departments is a vital affair in transportation activities and improvement of overall logistics efficiency. Among the coordination between transportation and other logistics departments my emphasis is close coordination and cooperation between transportation and purchasing department. In case of contracts with FOB supplier's plant, coordination is required between these two departments in the selection of transportation mode and routing, the performance of receiving and storage functions upon receipt of the material, and matters regarding the effect of transportation methods on the condition in which purchased goods are received.

b. Warehousing and Materials Handling

This section consolidates technical information to the I. I. N. on the subject of warehousing and materials handling operations involved

in the receipt, storage, issue, and care of supplies in the supply depot, shore bases, and mobil support ships stores. Here it is tried to establish briefly uniform efficient methods and standards at supply installations within each department of logistics organization.

For the purpose of storage and materials handling within the I.I.N., the decentralized system is suggested. This means that each department (ordnance, tech, supply, etc.) must be responsible for managing its own warehousing and materials handling activities. The recommendation takes into consideration the variety and unlike characteristics of materials and the different specialty and skills required to manage the activities. Storage and materials handling policies, procedures, and methods at supply installations must be uniform throughout each responsible department in the logistics headquarters.

(1) Basic warehousing operations

The contents of this section are not intended to prescribe all warehousing operations in detail. They are designed to indicate the most important activities within all the type of stores used in the I.I.N. logistics system. Considering the following principles contributes to improving the efficiency of the warehousing system.

a. Receiving

Receiving operations concern the manner in which supplies are brought into the naval supply system. Prompt and accurate processing of receipt is therefore, a prime requisite of effective

warehousing. The details of receiving operations is dependent on types of supplies to be handled, distance supplies must be moved, types of materials handling equipment available, and physical characteristics of the storage installation. The details of receiving based on the above mentioned factors must be prepared by each department for its own warehousing activities. However, the following basic principles of receiving are applicable to all types of storage used in existing system wherever supplies are received for storage and subsequent issue, shipment, or distribution.

(1) Planning the operation. The planning of receiving operations requires full coordination among the offices of the storage installation responsible for the different phases of the operation. The proper evaluation of information received in advance of actual shipment is of utmost importance to insure that appropriate steps be taken to receive the supplies as efficiently and economically as possible.

(2) Coordination. Since the workload in various receiving operations fluctuates, every effort should be made to maintain a balanced operation with minimum interference with other storage and materials handling activities. Consequently, the handling of receipts must be fully coordinated among all organizational units involved in receipt, storage, and shipment of materials.

(3) Spotting the carrier. Spotting the carrier is the process of locating a rail car or truck in the proper place for unloading.

Availability of advance document is necessary in order to determine the storage location prior to arrival of carriers. Warehouse supervisors should at least have a general idea through advance planning of where known arrivals will be stored.

(4) Unloading and moving the supplies to storage. The physical unloading of supplies should be properly coordinated with procedures involved in checking and inspecting the shipment. The movement of supplies to storage is a continuation of the unloading operation. The movement should be made by the most expeditious and economical means available. Matters for consideration include the selection of equipment to be used, the type of supplies to be moved, and the distance of the storage area from the carrier. In the case of ammunition and explosives observance of safety rules and regulations of ammunition handling operations is necessary. The ordnance department in the logistics headquarters is responsible for the publication of safety rules, regulations, and procedures to be followed in the handling of ammunition.

b. Protection of stock

Supplies should be stored according to the amount of protection required for each particular item. The amount and type of care required by any particular item will depend upon its particular nature and characteristics. Each department must have a knowledge of storage and preservation methods which must be applied to obtain maximum protection of stock; the preservation of any item to a great extent

is dependent on proper storage. In order to store properly the many stock items, carried at all logistics department's storage activities, the storekeeper, must know the characteristics of such items. Types of items requiring care in storage should be classified as: (1) explosive and flammable materials classified as hazardous - items (which are stored in secured vaults because of valuable and hazardous nature, such as missiles, crystal, and alcohol), (2) materials requiring refrigeration, (3) materials subject to damage from sunlight, oils, heat, or dampness, (4) materials which are explosive when stored in close proximity to other flammables, such as acetylene and oxygen, (5) materials subject to destruction by insects or rodents and requiring fumigation.

c. Rotation of stock

Rotation of stock should be based on the inventory principle of "first in, first out" (FIFO). Personnel supply items, such as subsistence, medical supplies, various technical supplies, and certain general stock items that are subject to deterioration or infestation have a limited "keeping time" or "shelf life." Therefore attention must be given to the proper rotation of such items. Items of this type which, are ready for issue, must be stored so that the oldest stock by date of manufacture, storage, or in some instances, the last preservation or lubrication date (whichever applies) should be issued first. Items requiring preservation should be processed through packaging prior to shipment.

d. Marking of materials for storage

If the individual containers or issue units are properly marked and stored so that each item in stock can be easily identified for issue or inventory control, the result will be more accurate stock accounting, more accurate issues, and improved inventory control. Materials not properly identified and marked at time of receipt are subject to improper storage and issue. Individual items, separate containers, or loads must be properly marked at the time materials are checked and identified. When materials are received in palletized unit loads it is not necessary to mark each individual container or box in the load. Materials received in unit loads should be checked an identified by stock number, unit of issue, quantity per box or carton and number of cartons per unit load. In case of ammunition, the type of shell, round, or cartridge, and caliber are one of the necessary information required to be identified and marked. This information should be marked clearly on the at least two sides of the unit load. The unit load should be placed in storage so that one marking will be facing the marking aisle.

e. Shipping

Shipping is a vital link in the chain of warehousing operations and must be efficient if the shore bases, mobil support ships, and operating units are to receive supplies on time, in the quantity requested, and in good condition. Effectiveness of this function depends

upon proper receiving, proper storage, and packing. The following principles must be considered in shipping items from the supply depot to shore bases and mobil support ships.

(1) Planning. The receipt, location, and storage of all supplies should be planned in such a manner which will expedite and simplify shipping. However, the planning for a specific supply movement should begin upon the receipt of the proper document authorizing delivery of designated items to a specific destination.

Planning should include the following consideration.

Total quantity to be shipped, total weight and/or cube to be shipped, special preparation for shipment requirements such as packing and marking, method of transportation, date required at destination and the number of required transportation units (truckloads or carloads) on the basis of weight and cut of material.

(2) Documentation. It is of utmost importance that all shipments be properly documented in order to eliminate delay, damage, or even loss. Unless properly documented there will be a delay in loading and turn-around time of equipment, delay in reaching destination, damage due to not being able to identify shipment not reaching destination.

(3) Requesting transportation. When freight planning and related activities have been completed, the shipping document should be routed to the warehouse where the supplies to be shipped are

selected and prepared for shipment. After the load has been prepared for shipment, the responsible department requests transportation of cargo to the destination from the traffic department. The request should include precise information such as weight, cub, nature of the load, and date required at destination. The transportation department should specify the mode of transportation and routing.

(4) Loading operation. A loading operation will be influenced by several factors: personnel and equipment available, carrier's equipment furnished, the characteristics of the material being loaded on the carrier's equipment, and the time limitation imposed on this operation. The requirements for personnel and equipment should be determined in advance of the beginning of the loading operation. Personnel assignment should include definite instructions as to the time, place and method of loading. Once a loading operation has begun, personnel assignments should be so regulated that all persons are fully engaged in the operation.

f. Record keeping in warehouses

It is far more important for the storekeeper to know exactly where all of the materials under his custody are located than to know how much is stored. In order to accomplish this basic responsibility, it is necessary to have an accurate locator system which will be the only record maintained by the storekeeper. The storekeeper should make every effort to establish and maintain a

storage condition wherein an accurate physical inventory could be taken without advance notice. Inventory taking is an essential supply function and must be considered with each phase of the storage operation.

g. Housekeeping

A clean, orderly, storage area is conducive to safe operations and to high morale of personnel, both of which are necessary for maximum efficiency of operations. The presence of foreign articles on warehouse floors, such as paper, twine, or rope, dunnage, and pieces of boxes, constitute an operational hazard and may cause personnel to slip or fall, causing serious injury. Also such items are a constant menace to fork truck operations and may cause serious accidents. The result would be considerable damage to materials, equipments, or to the members of the warehouse. Requirements for good housekeeping are:(1) Distribute sufficient waste containers throughout the storage areas to facilitate the disposal of all accumulated waste, (2) Require that all operating personnel remove all wastes generated by their activities, (3) Remove oil, grease, or other liquids which would make floors slippery, (4) Store all dunnage and boxes not in use in designated storage locations.

h. Materials handling

Materials handling as an activity center in military logistics has a very important role to play in improving efficiency by making the logistics system respond quickly and effectively

to user unit requirements. Materials handling plays a very key role in getting materials to operating units on time and in the proper quantities.

(a) Classification of materials handling equipment

There are various categories of equipment that can be used in existing storage system. Each type of equipment available on the market has certain general advantages and possible uses for particular types of materials. It would not be in my best interest to discuss in detail the engineering features of various types of materials handling equipment. The objective here is to recommend how and when such equipment should be used in order to increase the overall logistics system efficiency. Major materials handling equipment items are frequently classified into the following groups:

(1) Conveyers

(2) Warehouse cranes

(3) Fork lift trucks

(4) Tractor-trailer trains

(5) Hand equipment.

(b) Equipment selection by function

Each of the above mentioned equipments is designed and suitable for a specific set of warehousing activities

(1) Conveyors

Conveyors are very popular materials handling equipment, particularly where an attempt is being made to automate a warehouse

as much as possible. Conveyors are advantageous in terms of eliminating handling. Conveyor equipment with scanning devices and other automatic devices enable goods to be moved very efficiently and quickly from one area in the warehouse to another. Conveyors of either the roller or wheel type should be used for:

Loading or unloading box cars and trailers with unpalletized loads where fork lift trucks may not enter because of space limitations or absence of loading dock.

Transporting material to wrapping and packing areas, continuously picked orders which do not constitute a pallet load.

Processing materials in packing and preservation operations.

(2) Warehouse cranes

Warehouse cranes should be used to handle nonpalletized items, such as very heavy machinery, very bulky items, and large items of unusual shape not easily palletized. Also warehouse cranes should be used for handling material which must be moved in or out of space in which forklift trucks cannot be maneuvered.

(3) Fork lift trucks

Fork lift trucks are necessary for any warehouse operation for the tiering or the positioning of materials above other stored merchandise and also for horizontal travel. However, their low speed makes the use of tractor-trailer trains more economical for transportation of bulk lots of materials over distances in excess of 400 feet.

(4) Tractor-trailer trains

Tractor-trailer trains constitute a trackless railroad for horizontal transportation of materials. Use of the tractor-trailer train to transport rrailer loads of materials releases the fork truck for its proper function and provides efficient horizontal transportation.

(5) Hand equipment

Hand equipment includes 2-wheel trucks, 4-wheel trucks, and such specialized items as stock picker trucks. It should be used for transporting light materials, small items, or items of infrequent issue or receipt not handled in palletized quantities. Also, hand equipment should be used where aisle width precludes using power equipment or, in emergencies, when speed is essential and manpower is available to supplement power equipment.

4. Repair and Maintenance System

The technological advance in military equipment and systems during the past two decades have increased the complexity and costs of weapons and equipment. Since the responsiveness of naval forces depends on the continuous readiness of equipment, it is imperative that the repair and maintenance department take actions to insure that equipment is repaired and maintained at a maximum state of readiness at a minimum total cost.

All repairs and maintenance management functions at Naval level should be assigned to the repair and maintenance department in

the logistics system. This responsibility consists of formulation of policy and providing procedural guidelines for the repair and maintenance of all kinds of equipments and systems available in the Navy. The subordinates charged with accomplishment of these responsibilities are the docks, repair and maintenance factories, and workshops in repair ships, shore bases and supply depots. The basic objective of these agencies is to contribute to the readiness of the Naval services by improving the effectiveness and economy of repair and maintenance operations.

(a) Repair and Maintenance Levels

In the management of repair and maintenance, the Navy should apply four levels of repair and maintenance. The level one (organizational), level two (intermediate), level three (depot), and level four (supplier).

These levels are distinguished by differences in capability of the facilities concerned, rather than by the type or kind of repair and maintenance performed.

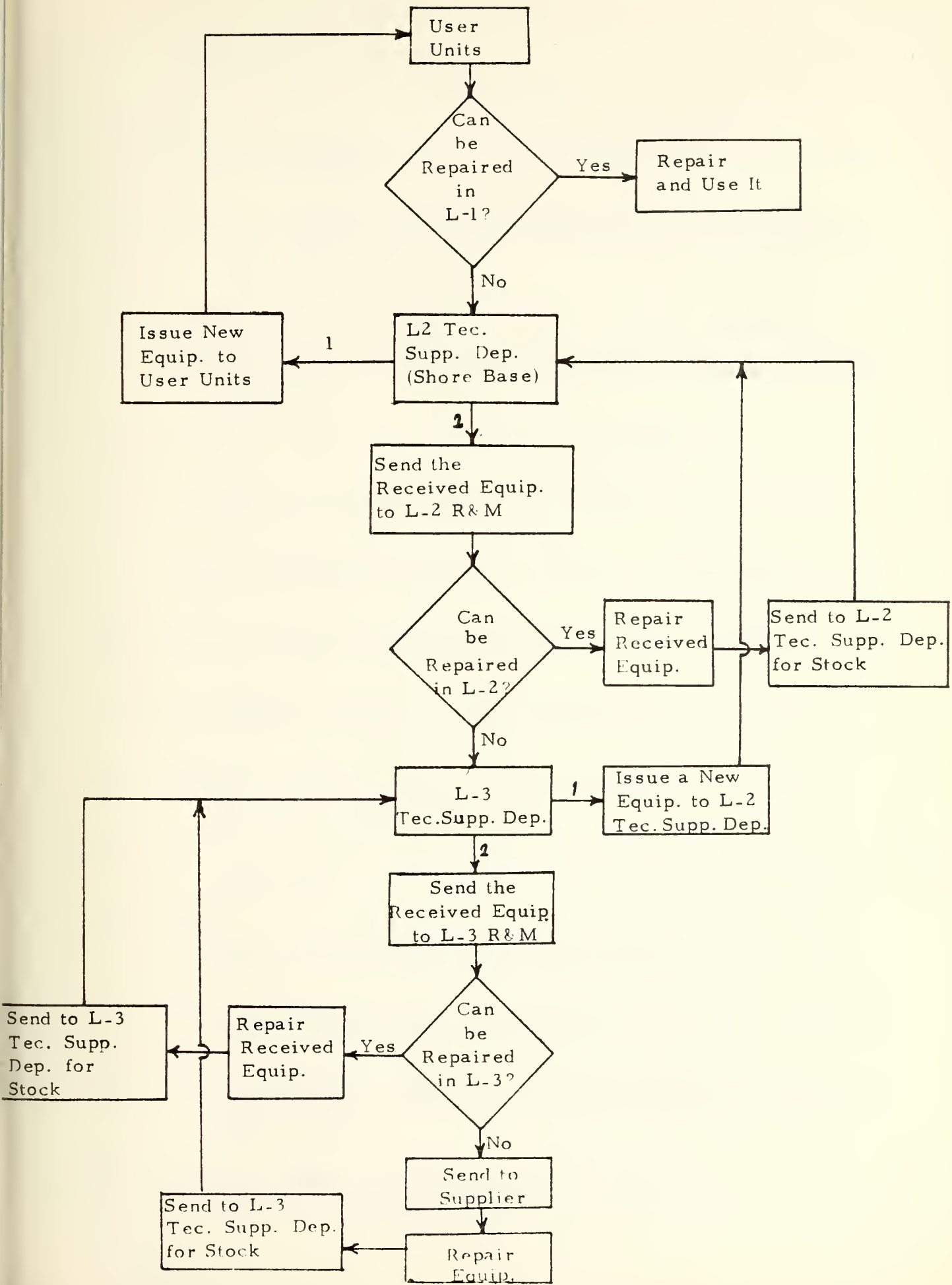
Level-1 repair and maintenance in the activities which is the responsibility of and performed by or using organization on its assigned equipment. Its phases normally consist of inspecting, lubricating, adjusting, and replacing parts, minor assemblies, and sub-assemblies. The organizations responsible for these functions are ships and other operating forces.

Level-2 or intermediate repair and maintenance is that activity which

is the responsibility of and performed by repair ships, and/or shore bases for direct support of using organizations. Its phases should consist of calibration, repair or replacement of damaged or unserviceable parts, components or assemblies, emergency manufacture of non-available parts, and providing technical assistance to using organizations.

Level-3 or depot repair and maintenance is that maintenance which is the responsibility of and performed by designated maintenance activities to increase stocks of serviceable material and to support organizational and intermediate repair and maintenance activities by the use of more extensive shop facilities, equipment, and personnel of higher technical skill than are available at the lower levels of repair and maintenance. Its phases should consist of repair, modification, alteration, modernization, overhaul, rebuild of parts, assemblies, sub-assemblies, components, and end items. Depot maintenance should be accomplished in repair depots or shipyard facilities.

Level-4 or supplier repair and maintenance is that repair and maintenance which cannot be accomplished in each of the Naval repair and maintenance facilities. In this case according to the repair and maintenance term of the purchasing contract, equipment or system should be sent to supplier's facilities for necessary repairs. The repair and maintenance process in the proposed logistics system is indicated in flow chart 4-5.


User Units
Can be Repaired in L-1?
Yes
Repair and Use It
No
Issue New Equip. to User Units
1
L2 Tec. Supp. Dep. (Shore Base)
2
Send the Received Equip. to L-2 R&M
Can be Repaired in L-2?
Yes
Repair Received Equip.
Send to L-2 Tec. Supp. Dep. for Stock
No
L-3 Tec.Supp. Dep.
1
Issue a New Equip. to L-2 Tec.Supp. Dep.
2
Send the Received Equip to L-3 R&M
Can be Repaired in L-3?
Yes
Repair Received Equip.
Send to L-3 Tec. Supp. Dep. for Stock
No
Send to Supplier
Repair Equip.
Send to L-3 Tec. Supp. Dep. for Stock

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